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The ELECTRICAL REVIEW

FOUNDED 1872

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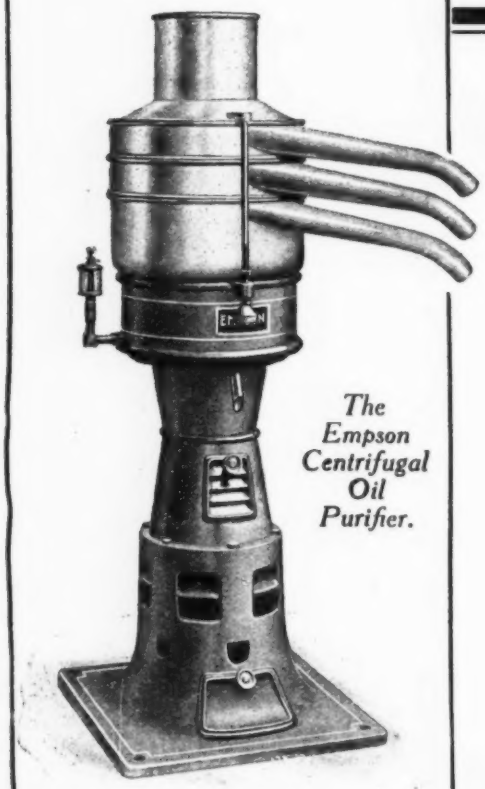

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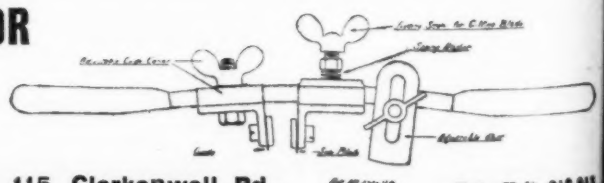

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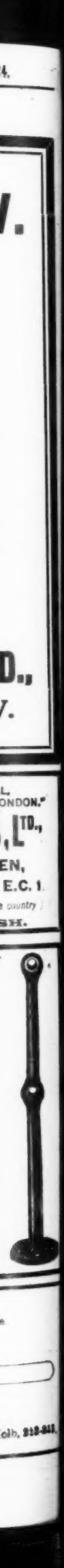

The

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Inadequate Records.

THE announcement that the Board of Trade will next year take a census of production of Great Britain in respect of 1924 brings up the general question of the preparation and publication in this country of trade and industrial reports and statistics.

We have called attention on more than one occasion to the delay which often takes place in the issue of Government reports, and quite recently we have discussed at length the adverse effect on industry and science of the high charges made for them.

Considering this country's great importance and long history as a manufacturer, she is singularly lacking in records of her factory output. No census of production at all was taken until 1907. The second was partially carried through in regard to the year 1912, but the outbreak of the Great War interfered with the completion of the returns, and consequently no report on it was published. The data, however, are said to be available for comparative purposes.

In contrast with this unfortunate silence regarding British industrial progress, which admittedly is to some extent excusable in recent years by reason of the country's preoccupation with the war, the United States takes a biennial census of a very detailed character.

As the schedules for the British census are now in preparation, it may be interesting to compare the classification of the only available census report in this country with that of the American census. In our 1907 census the production of the electrical manufacturing industry was returned under less than twenty headings. It is true that machinery was separated into five divisions, *viz.*, (1) d.c. and a.c. generators; (2) d.c. and a.c. motors; (3) motor generators, &c.; (4) switches; (5) switchboards; but in contrast with this only fairly liberal classification, electrical instruments were all lumped together, as also were telegraph and telephone

cables (save that submarine were distinguished from land), whilst under the heading of electric power and lighting cables, the only sub-divisions were (1) paper and bitumen insulation, and (2) rubber insulation. On the other hand, in the report on the American census of 1921 output values were given in respect of 45 different items. There is a wealth of detail of the utmost value.

We are aware that manufacturers are not eager to give Government Departments a large amount of more or less confidential detail about their purchases of raw material, the number of their employés, and the value of the output of their different lines of production. Not unnaturally they are afraid that some of these particulars may come to the ears of their competitors or customers. For these reasons, while they realise the utility of general comparative statements regarding the productive activities of the country, and to that extent sympathise with the objects of the census of production, they are disinclined from a personal point of view to give away what may be regarded as trade secrets without feeling sure that their confidence will be respected.

It is this anxiety that the Government is anxious to alleviate. The Board of Trade, in a recent issue of its journal, expresses the hope that there is no longer any doubt in the minds of manufacturers and others as to the secrecy observed with regard to their returns. These, it is said, are not communicated to any other Government Department for any purpose whatever. They are not allowed to be published so as to disclose the business of individual firms, and they will only be used in the compilation of totals of a general character. The improper communication to any person of any information obtained in connection with the census is visited with severe penalties on both the giver and the receiver, and as a precaution, the name and address of the firm making the return are removed from the schedule before it passes into the hands of the census staff engaged in examination and tabulation. The Board states that before the details of the schedules are finally determined there will be full opportunities for personal consultation with industrial associations, Chambers of Commerce, and other organisations whose co-operation may be helpful. Meanwhile, a small general advisory committee will be appointed to advise the Board on the major questions that may arise. The B.E.A.M.A., which has on more than one occasion advised the Government Departments on such matters, will no doubt be willing to co-operate on this occasion.

Not only in the matter of records of the output of our factories does this country lag behind the United States. Our import and export trade statistics contain far less detail, whether of the classes of goods or the countries with which the trade is done, than the American returns. The latter as a rule are published more promptly than ours, except perhaps the monthly accounts. There was issued during February, 1924, a volume relating to British trade in 1922 at individual ports of the United Kingdom and with individual countries. At about the same time the December summary of foreign commerce of the United States came to hand, giving for the complete twelve months of 1923 infinitely greater detail as regards commodities and almost as much information as regards countries, as the British trade statistics. Furthermore, the annual statement of American Foreign Commerce gives details of the country's trade with every other State in the world, whereas our annual statement deals only with a relatively limited number of the more important territories.

In the matter of cost, we compare very badly with Washington, which takes the view that the more widely and cheaply commercial information is distributed the better it is for the trade of the country. The publications of our Government have become almost prohibitive in price. The issue of the monthly trade accounts, for example, costs 6s. 3d., while Volume 4 of the annual statement costs 21s. 9d. These charges look absolutely absurd by the side of the American, which are 10 cents for the monthly summary and $1.50 for the annual volume.

Electricity in Advertising.

The discussion before the Illuminating Engineering Society on March 21st illustrated two important applications of electricity in the advertising field, for show-windows and for illuminated signs. Miss M. Partridge, who dealt with the former problem, is a member of the Women's Engineering Society, who has made a special study of this field—obviously one where ladies should be able to do useful work. Both she and Mr. G. P. Garbett, who dealt with illuminated signs, sought for some explanation of the fact that London uses less light for publicity than American cities do. No doubt, as the latter suggested, early objections and repressive legislation had an effect, though the more sedate lines on which our signs have developed are not to be entirely regretted. Possibly, too, the more out-of-door life customary in the evenings in Continental cities is a factor. Mr. Garbett complained of the involved and contradictory nature of many regulations, and we agree that there is room for simplification. Whilst as electrical engineers we desire to see the fullest use made of electricity for publicity, as citizens we do not wish its use to result in disfigurement. Obviously there is room for exchange of views between those interested in both aspects. We hope that the Illuminating Engineering Society will be able to bring about concerted action which should make London not merely a brighter city, but one in which the brightness is achieved with a maximum of good taste.

Pyrometric Control.

Electrical engineers can justly claim to have played even a greater part in the introduction of the pyrometer to the workshop than metallurgists; therefore they have a special interest in the controversy which is taking place in certain technical journals as to the practical applications of pyrometers. The answer to those who approve of the pyrometer in the laboratory and criticise its usefulness in the workshop is best given by asking, as one writer on steel thermal treatment has done, what would be said of a mechanic who proposed to carry on his work without the aid of even a foot-rule? And what would be thought of the products of an engineer's workshop in which such a thing as a micrometer was unknown? It is said that many engineers occupying important positions can remember the day when they used to ascertain the quenching temperature of steel, by determining whether a piece of wood ignited when rubbed on the hot metal, and that a still greater number, if asked the temperature at which a steel spring is tempered, would confess their ignorance. But the day of rule-of-thumb is passing. Accurate measurements form the basis of even moderate success in steel treatment by heat, and the quality of castings, whether ferrous or non-ferrous, so largely depends on correct pouring temperature, that no up-to-date foundry can afford to rely on eye judgment. Radiation, optical, and thermo-electric pyrometers have each special and peculiar merits, although the last-named is the most popular for workshop use. No pyrometer is perfect, but neither is any furnace or machine tool—the point is that most pyrometers made to-day are reliable and strong, and readings can be taken by the most unscientific person.

Works Interconnection in Germany.

A new kind of transmission undertaking has been formed in Wurtemberg by the constitution of the Bus-bar Company (Sammelschienen Gesellschaft) with the support and participation of the State of Wurtemberg and the adhesion of ten electricity supply stations and hydro-electric works. The object is the construction, acquisition and working of high-pressure installations, particularly of lines connecting generating stations together, as well as the purchase, transmission and distribution of electrical energy. By means of the systematic development of interconnecting lines it is hoped to utilise the productive capacity of the hydro-electric works to the utmost extent on the one

hand, and on the other to supplement and replace these, should the occasion arise, by the use of power from the steam generating stations. The State of Wurtemberg is participating in the share capital of the company to the amount of 26 per cent., while loans will be raised for the financing of extensions of the networks to be brought under the control of the company.

Electrical Vehicles in France.

The Union des Syndicats de l'Electricité has now issued a report respecting the trials of electrical vehicles which were organised last September by the Union in conjunction with the Automobile Club de France and the Laboratoire Central d'Electricité. It is stated that 17 vehicles were entered for the trials, and 12 participated, the remaining five being too late to make an appearance. The runs were made in Paris and its suburbs, and included some severe gradients which were easily mounted. The distance of the trials varied according to the type of vehicle; it was 54½ miles for the light vehicles, 44½ miles for the small delivery vans, and 25 miles for the heavy delivery vans. As to the results of the trials, it is mentioned that as compared with vehicles equipped with internal-combustion engines, the electrical vehicles show an economy of from 10 to 20 per cent. in the matter of all expenses. The consumption of energy per kilometre per ton is stated to have fallen to 55 watt-hours for certain small vehicles and delivery vans. It is considered, as a result of the trials, that an important market has now been opened for this type of car for certain uses in towns, but that until charging stations have become more numerous in the country districts, electrical vehicles will not be largely used for touring purposes.

Norwegian Electricity Works.

We recently referred to the question of the indebtedness of a number of municipal electricity works in Norway, which were established during the time of the war to meet the difficult situation arising from the uncertainty concerning the imports of coal and of petroleum in that period, and which are unable to meet their financial charges at the present time owing to the high costs of construction and equipment of the works. It now appears that the Norwegian Storthing has sanctioned a grant of 3,250,000 kroner in aid of these particular undertakings. The Forest and Water Power Committee, however, entertains great scruples as to the consequences which may arise from a grant of this nature, although the committee has associated itself with the government proposal, taking into consideration the extraordinary circumstances of recent years, which constrained the communes to establish hydro-electric works. As to the distribution of the grant among the financially affected works, it is stated that no fewer than sixty applications for aid have been received, and these will be examined technically and economically shortly, while government officials will confer with the creditors of the works concerned. It will, however, be impossible to satisfy the demands of all the works for financial grants. At the same time the question of the constitution of an electricity bank is under the consideration of the Financial Department of the Board of Trade, and it is not impossible that a municipal bank will be created which will also occupy itself with the question of electrical credits.

Chartered Electrical Engineers.

At the meeting of the Institution of Electrical Engineers on Thursday last week, the President, Dr. Alex. Russell, announced that the Privy Council had formally approved the new by-law which conferred upon Corporate Members the right to style themselves "Chartered Electrical Engineers." No doubt this privilege will operate to accelerate the growth of the membership, which is already rapid and well maintained, and we trust that it will in some measure assist in raising the status of the profession, though doubts have been expressed regarding its efficacy in creating an impression on the public mind. "Living down the past" is usually a painfully protracted process, and the misuse not only of the term "electrical engineer," but also, and to a far greater extent, of the term "engineer," is so deeply rooted in the English-speaking countries, which were the pioneers in engineering, that it will be very difficult to eradicate. On the Continent, on the other hand, where engineering is of more recent growth, it is a title of honour like that of physician or lawyer. Until recently the workers in engineering workshops had the word "engineers" in the title of their trade union, and even to-day a union composed of locomotive drivers and firemen arrogates the title for the former class. Small wonder, then, that to the general public an engineer is still a man with a spanner and a piece of oily waste. Glancing through the pages of a London evening paper on Monday last, we noticed three cases in which "engineers" appeared where "mechanics" should have been used. It is on record that a navvy described himself as a "civil engineer," and only last week there was a strike in the building trades at Manchester because the paviours were transferred to the "civil engineering branch."

The distinctive feature of a properly-trained engineer is that he exercises initiative; he plans for and supervises others, whilst an engine-driver or fitter is concerned only with carrying out his own duties. A similar distinction obtains between an artist and a painter, an author and a typist; but no such confusion arises in the public mind with respect to these occupations. The result is that whilst the work of the engineer contributes to the comfort and efficiency of the citizen throughout the day, in ways often wholly unsuspected by the latter, the engineer gets little credit for his achievements, and engineering is hardly recognised as a "profession" in cultured circles.

The "chemist" is in a somewhat similar predicament, in that to the man in the street the term suggests an apothecary rather than a Ramsay or a Dewar.

Railway Electrification.

This subject has come under discussion at recent meetings of the Institution of Electrical Engineers and other bodies, and it has been pointed out that many of the extensive projects which were under consideration before the railway grouping scheme took effect have been put on the shelf, apparently as a result of the amalgamation. This is a very regrettable circumstance, for we looked to the speedy electrification of our railways for a notable reduction in the amount of unemployment in this country; moreover, we believe that by adopting this policy of procrastination the railway authorities are acting contrary to their own interests, as well as to the interests of the nation as a whole. The immediate benefits accruing to the companies from the electrification of their lines were admirably set forth by Sir Philip Dawson, M.P., in the speech reported on p. 516 of our last issue, and Lieut.-Col. H. E. O'Brien, D.S.O., has done good service by collecting the arguments in favour of electrification in a convenient form—an abstract of his paper appears elsewhere in this issue. It is of the utmost importance that we should proceed with the electrification of our railways, not only for the benefit of our own people but also for the sake of our railway undertakings overseas; if we cannot show our faith in electric traction at home, we shall be in a false position when we endeavour to obtain contracts for railway electrification abroad.

Apart from the actual merits of the question from the railwayman's point of view, it should not be forgotten that many subsidiary advantages would be derived from the presence of electric power lines accompanying the railways, through the heart of the country; for instance, electricity would become available for industrial purposes, for agriculture, &c., at innumerable places where otherwise it could not be provided for many years, and a social revolution of the most beneficent kind might thus be brought about.

D

The Single-phase Induction Motor.

Facts and Fancies of a Change-over.

By E. M. B.

"In man's most dire extremity oft succour dawns from Heaven."

If Pepys had lived in this electrical age, and had suffered to earn his livelihood as a mains man conducting change-overs, the above quotation in his diary would have covered a multitude of sins, sorrows, and surprises, and yet have seemed to be the only possible explanation of many of his experiences with single-phase induction motors.

Let us start with some facts. The machines were all standard, and were made by various well-known manufacturers. There were various sizes, from 7 to ⅛ h.p. One 7-h.p. machine had a variable rotor resistance, but the remainder were of the squirrel-cage type. The starter for the wound rotor machine had in it a choking coil. The starters for the remainder of the larger sizes had the usual spiral resistances, and the toy sizes were controlled by "Twinob" switches.

The writer has often heard lecturers state that the single-phase induction motor "is not very stable," and has gained marks by using this phrase in answering examination questions, but it needed a change-over to help him to understand what was meant by "not very stable." It is thus that fancies are turned into facts. In his present state of mind he thinks that Solomon was the man who said that a single-phase induction motor would not start if placed in a draught. Not that starting is the only trouble, but it has the advantage of being the beginning of them.

A change-over brings one gratifying surprise, and that is to learn the variety of small businesses that use electrical power. One expects to find the fish and chip merchant so equipped, but surely the limit is reached now that grocers have their cash registers motor-operated.

While the engineering difficulties of a change-over can be simply stated, even if not explained, the chief difficulty, which is the reconciliation of the consumer, is neither easy to state nor to effect. The first question the owner asks is: "What authority have you for coming and," as he persists in putting it, "pinching my motor and leaving that miserable thing in its place?" The offence is aggravated by the fact that the a.c. motor is much smaller, in the larger sizes, than his d.c. machine. There is a surprising difference of size between the modern ball-bearing a.c. machines and the antediluvian d.c. machines of Brobdingnagian proportions, which are unearthed by a change-over. However, perhaps it is not fair to be satirical, as they start and continue to run under their various loads, which is more than can be said for some of their elegant a.c. sisters.

A word or two on tendencies of modern design, and pointing out that owing to lack of a commutator the repair bill will be negligible, and the average consumer will be resigned to his fate—one cannot by any imagination write "satisfied." He admits as much when he says that as the Corporation seems determined to carry out this new-fangled scheme he might as well shut up. To the stubborn man who refuses to allow his motor to be removed, and you will meet him, be honest and say that he can keep his motor if he wishes, but casually mention that it won't run. It is remarkable with what alacrity the most conservative mind will seize upon this last phrase, and use it as a text for the sermon which follows on the thieving propensities of corporations.

In the toy sizes it will be found that the a.c. motors are much bigger than the d.c. ones. This gives rise to much heart-burning and comparison of labels, as the consumer is convinced that a change-over is a scheme whereby his consumption will be increased; and the giver of a new motor for an old, a modern Aladdin.

Owing to the difference in size, the same bed cannot be used, and if the motor is to be fixed on a concrete floor the consumer will be annoyed at having to wait until new rag bolts can be fixed, although he will not tolerate any makeshift device. Truly, a case of using one's own judgment—his growl will come in any case.

But it is when everything is ready to start that the engineer knows that the trouble is about to begin. He can only hope, for he knows by experience that the odds are against the motor picking up. The consumer, having heard of a pal's experience in a previous change-over, waits eagle-eyed, convinced that his prophecy is about to be fulfilled—"that thing won't start."

It is generally considered that the starting torque of a single-phase, squirrel-cage motor is 1/6th of the full-load torque. Whatever it may be, generally it will not start the machine, and very often it will not start the belt and shafting; in such cases they could easily be turned by hand. In some cases the shafting, &c., was stiff, but as the consumer most irritatingly pointed out, the d.c. motor did it. Words fail the writer when he trys to convey the feelings aroused in him by the constant repetition of that innocent phrase.

In one case a 1½-h.p. motor was driving a sausage machine, which was connected through a countershaft on which was a loose pulley. It would not turn the shafting alone. A 3-h.p. motor was substituted, but with the same result. The countershaft was taken out, and the motor connected direct to the loose pulley of the machine, but even then unless the belt was pulled very carefully on to the fixed pulley of the machine the motor would be stopped.

The starting current of a 1½-h.p. motor was 30 amperes. The 2- and 3-h.p. motors also took the same. The no-load current was 3 amperes. It was useless putting in less than 30-ampere fuses, and even they would not survive more than half a dozen times of starting. If the motor did not turn on being switched on, or only turned at some low speed, or even stopped, the current was 30 amperes and would not blow the fuses, but the motor soon started to smoke. Careless handling has baked many of these machines.

Evidently, the designer fondly hoped that his machines would run up straight away, for the motors, and especially the starters, began to smoke within a minute of this current passing. There were two weak points in these installations: one was the starter, and the other the motor terminals. Oh, that motor designers were motor users!

The writer will agree with previous Review articles that no-load and overload releases are superfluous on these machines, but will someone tell him what to say to the consumer who has an a.c. motor installed, minus these devices, by the corporation, when that same body refuses to connect his d.c. motor also without such devices? It is at such times that technical explanations are superfluous.

Consumers have to be taught how to start an a.c. motor. This is an essential, though difficult, task, but the thing would be easy if only they would forget the d.c. way. They *will* push the handle straight over. Every reader will know that the motor must be up to a fair speed before the starting winding is cut out or else it will not run up. This winding is generally connected to the second stop, but talk as one will, consumers will not pause on this stop. One must be prepared to give starting lessons for about a month after the change-over. Time after time consumers "rang

up" saying that the motor had lost its power, but it was only because they would not pause on that stop.

By the way, if any lamp, switch, or fuse, refuses to function within 12 months of the change-over the consumer will hold it responsible. Again, one finds many earth wires missing. They got in the way and were removed.

One motor gave trouble; it would not start. On investigation it was found that it was about 40 yards from the service, and the leads were 3/20. This was all right for d.c., but with the 30 amperes a.c. starting current the drop was about 30 volts, and although the motor would turn it would not run up to speed. Rewiring was the only remedy.

A d.c. motor is a silent running machine, but an a.c. one with a fan mounted on the shaft, and especially during the starting period, is not by any means silent. Consumers wanted a quieter machine, especially when it was required for a house or a shop. One motor, which was used in a hospital, was mounted on felt.

Every engineer knows that the single-phase induction motor is at a disadvantage compared with the d.c. motor, but the consumer does not. What should be done: Tell the consumer, who will assuredly find out; or bluff him, which often can be done? It is best, fairest, and easiest in the long run, to tell the consumer that he will have to put up with the disadvantages. Some consumers will be aghast at what they call "the infernal cheek," of giving a new motor which is known to be inferior to the old one, but this type would grouse at whatever was done, so he is just left to Father Time for reconciliation, or consolation; and Time worketh wonders. Most people are very reasonable, and some do much to help, when they have had an explanation; and how much in these jobs does the personal element count!

Motor changing for such machines as are used for dental and similar special businesses is best handed over to the manufacturers of the apparatus. In the case of a special machine, a motor-operated cash register, the new motor duly arrived, and only wanted placing *in situ*. The motor pulley was a cog which was one of a chain forming an intricate timing gear. The old motor took some getting out; the new one took more putting in, but finally it got there. Unfortunately, when the "shut" stop was pushed the door would remain open, and when the "open" stop was touched the door promptly closed. Obviously, the gearing was set wrongly, and so the motor had to come out again. But that motor had ideas of its own, and it refused to budge. Of course, it did come out, but how, no one knows. The writer, on taking his hands away to go and look for a sledge-hammer, found the motor therein free from its gearing. Putting it back was just as bad. "Special machines are best left to the makers."

The writer does not love induction motors; he prefers the series class, or some type of repulsion motor. Single-phase induction motors are so unreliable. The same motor will run a machine one day and not the next. If the rotor is in one position relative to the field it will run; if in another, it will lock itself. Have a motor running on Saturday morning, leave it over the week-end and the atmosphere may cause a slight belt contraction and the motor will not pick up on Monday morning.

They seem to run much better when they are hot. One may try half-a-dozen times to start a motor and it will not start, but by the seventh time it will be hot, and will probably run up. If a consumer asks for assistance, ask him to try and run it up. Perhaps it will not, but the preliminary heating thus obtained will be very helpful to one in starting it.

Figuratively speaking, "in man's most dire extremity oft succour dawns from Heaven," but one is inclined to blame the cussedness of single-phase induction motors. A change-over brings its ills, but it is a boon because one gains much experience of motors, and especially of men.

Facts and fancies—the writer guarantees the facts and feels certain that others will be able to separate the fancies from them.

The Selling of Radio Apparatus.

(Some of the Difficulties.)

By E. ALEXANDER.

The successful selling of radio apparatus depends more on the efforts of the selling executive than does any other type of selling. Radio salesmanship is a specialised calling, and to successfully direct a sales campaign requires a very specialised knowledge of the articles to be sold.

In the first place, there are three distinct classes to be served, as covered by the three separate licences issued by the Postmaster-General. The first of these is the broadcast listener or B.B.C. stamp type of customer; the second is the home constructor, or make-it-yourself class; whilst the third is the experimenter. In the past the experimenter formed the only wireless buyer, but he has now given place to his rival, the constructor, who has been amplified to an enormous degree by the "home-made" broadcast listener.

Now, to cater for these three divergent classes successfully requires a very specialised knowledge of the requirements of each. These are, broadly speaking, as follows:—

The broadcast listener requires a musical instrument, an article similar to a gramophone, which requires very little manipulation, gives no trouble, and is self-contained in one cabinet.

The second, the home constructor, requires sets which are not assembled, the component parts, in fact, with ready-drilled panels, and cabinets or baseboards for the lay-out, together with full instructions for assembling these sets. It is an extraordinary state of affairs that this class of customer should exist at all, but exist he does, and his wants have to be provided for.

The third is the experimenter. This class of buyer is very easy to satisfy, requiring only components—true, of the highest efficiency, but yet component parts only.

In planning a sales campaign, it is impossible to exclude any of these classes, going all out for the remaining class. It is, of course, obvious that the most numerous class is the broadcast listener, and to him the main appeal has to be made. The whole selling campaign must be based on his probable requirements, but at the same time the enormous number of home constructors have to be thought of and catered for; and we always have the experimenter.

It is fairly obvious, then, that to direct an organisation which successfully sells under these three headings requires specialised knowledge, not only of selling, but of the subject, and the radio sales manager must of necessity have radio as well as selling as part of his make-up.

Some critics of the sales and advertising efforts of the radio manufacturer declare that the whole scheme is wrong, and that the results, music and speech, should be sold and not the apparatus, and with this one is bound to agree, but the Government has had quite a

lot of say in the radio question, the industry is new, and there is not yet the money for the wider appeal which these critics demand.

If the campaigns of the various manufacturers of radio apparatus were to be studied, it would be found in each case that one definite class of wireless user had been "gone all out for," whilst the other two had been treated as side lines. Very few of them, however, have made the broadcast listener the main object of their attack.

It is not proposed in this article to discuss the rival merits of the three propositions; the difficulties, however, of such a campaign are being pointed out, and a suggestion made for a definite progressive sales policy.

In addition to the type of buyer to be selected, there is the difficulty of the type of seller to be chosen. In the first burst of enthusiasm for wireless, retailers and traders of all descriptions took it up, and took it up very badly. They did not know anything about it, and did irreparable damage to the trade. One has, therefore, to discriminate even concerning to whom the goods should be sold. It is obviously a short-sighted policy to sell to any sort of trader, whilst if kept within too narrow limits progress will be so slow that few will be able to last out until the corner is turned in the industry.

The motor factors took the matter up, and added new troubles for the radio sales manager; they demanded their large factors' discounts, and it became impossible, with such a young and competitive industry, to give the retailer such discounts as made it really worth his while to take up radio. By selling anywhere they are, in fact, treading on very delicate ground indeed, and only by a very wise selection of customers can any lasting success be made.

At the beginning it was necessary to educate the people who were to assist—namely, the salesman and travellers, but the use of the latter is a most difficult matter. They are usually young and enthusiastic people who dabble in wireless, and think they can sell; they can't, and are best left out of one's calculations altogether.

In wireless as in, perhaps, no other type of salesmanship, service counts more than anything else, and unless good service is the basis of the sales policy it will fail. Customers must feel that they will receive as much attention after they have purchased and paid for their set as they do before they become the owners. If necessary, a charge can be made in a similar manner to the practice adopted by large piano firms which, for a quite moderate sum, keep the piano tuned and in efficient working order for a year; the service must, however, be there or that confidence which is so necessary will be lacking.

Another factor, and one bringing great difficulties in its train, is the rapid progress that radio makes. Little points in design, new and more efficient accessories, and even new principles, change the whole scheme, and what a short time ago looked like a safe line to manufacture and sell in quantities becomes obsolete, and has to be worked off at greatly reduced prices or scrapped. The effective sales campaign must steer clear of all these difficulties and choose a path, not an easy one, which will bring success in spite of the difficulties.

The Comparison of Switchgear Quotations.

By An ESTIMATOR.

When comparing a number of tenders for switchgear it will often be found that the prices quoted vary very little, and that all the offers comply generally with the requirements of the specification. The difficulty of making a choice in such a case may be simplified by the following remarks, from one with inside knowledge, on the small points which make the difference between a good and an indifferent job.

Ammeters and voltmeters will probably be of the moving iron type, and should be spring controlled, as it is not easy to ensure the exactly vertical position required for gravity controlled instruments; the latter are a few shillings cheaper than the spring-controlled pattern. Length of scale should be given in addition to diameter of dial. All the instruments should be provided with a pointer clamping device for use during transit, and an external zero adjustment.

If the load to be controlled is unbalanced, care should be taken that watt-hour meters, &c., are specified accordingly. The term "polyphase" usually disguises a balanced-load instrument. Separate current transformers should be provided for the operation of watt-hour meters unless the trip coils are fuse-shunted, and the meters should always be calibrated with their current transformers; if this has been included the fact will almost certainly be mentioned, as it adds a pound or two to the price. In connection with watt-hour meters, it should be remembered that fine feathers do not necessarily make fine birds, and the works inside a house-service pattern case are probably identical with those displayed behind the glittering plate glass of a full-switchboard pattern case. The difference in cost is accounted for by the fact that house-service instruments are made in hundreds, and switchboard pattern cases in ones and twos.

If there are a number of circuits on a switchboard each having potential-operated instruments, some manufacturers may suggest operating them all from one busbar potential transformer. This arrangement may save money, but care should be taken in connecting potential transformers direct to the busbars; isolating switches and limiting resistances should certainly be provided, in addition to e.h.p. fuses.

If triple-pole protection is called for, beware of "Z" connected trip coils or relays; this arrangement saves one trip coil or relay, but the protection afforded is rather uncertain. If a small battery is required for use with relays arranged for independent tripping, the battery cannot be considered complete without a small ammeter, resistance, and push-button for testing purposes.

Isolating switches of the knife type should be provided with safety catches. It will be found that some manufacturers include an operating hook in their main price, others hide it among the extras.

The rupturing capacity of the oil circuit-breakers included may prove the deciding factor, but in comparing similar sizes and designs it may be assumed that the rupturing capacity claimed will vary, roughly, inversely with the experience and reputation of the manufacturer. A tank lowering device is really a necessity for tanks above about five gallons capacity, and draw-off taps and oil level indicators should be fitted. Oil may or may not be included in the price quoted; it is better to use oil supplied by the manufacturers, as then the oil cannot be blamed in the event of a breakdown.

Quotations for switchboards of the slate or marble flat-back type should state the thickness of the panels, and whether the fixing bolts and live stems passing through the panels are bushed.

If the purchaser is erecting the board, as is usually the case with export jobs, inquiry should be made as to how the gear is dismantled for packing. Some manu-

facturers entirely dismantle cubicle type boards, a procedure which saves shipping charges, but considerably increases the cost of erection on site.

Some of the points mentioned may appear unimportant, but they all make a difference in price. Some manufacturers like to give a main price as low as possible, and quote many items as extras, in the belief that purchasers ignore the extras in comparing tenders; the writer believes that nothing irritates a customer more than a long list of extras which has to be studied to enable a proper comparison to be made between various quotations.

In return for these few hints, may the writer implore all those who send out switchgear inquiries to mention, at least, the voltage and type of system for which the gear is required? It's so helpful!

Isolation of Machine Vibrations.

By A. B. EASON, A.M.Inst.C.E.

A case recently occurred where considerable vibration was caused by the running of a small motor in association with the running of charging generators, each giving 130 amperes at 60-78 volts. The machines are installed on the first floor of a brick building upon a reinforced concrete floor. The telephone operators' rest and refreshment room is adjacent to the room containing the power plant and switchgear. In the middle of the rest room there is a column which forms one of the supports of the floor of the apparatus room, which contains the automatic plant, consisting of preselector and selector racks. Immediately above the column are the "interrupter" racks, each carrying a 1/16-h.p.

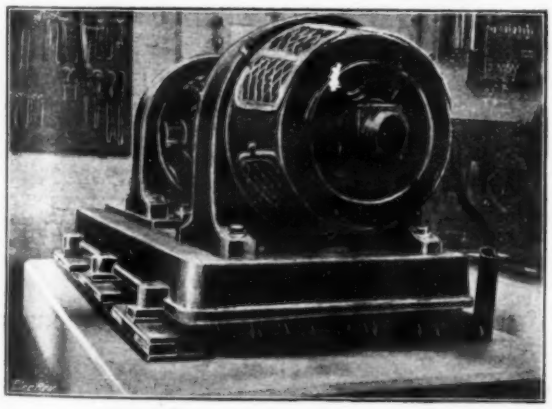

Fig. 1.—Charging Machine on Anti-Vibration Supports.

machine to supply current interrupted 30 and 60 times a second to drive the switches. Under the floor of the rest room is a ventilating duct leading to the fan in the power room. The relative disposition of the plant which might create disturbance is therefore:—Two charging machines of 12 h.p., and a ventilating fan of 1 h.p., in the power room, and two interrupter machines of 1/16 h.p., in the room above.

Trouble from vibration arose very shortly after the charging machines were installed, if either one or both were running; a series of iron lockers in the rest room were shaken, and the doors rattled all the time a charging machine was running, and there was considerable vibration on the floor; no one could dispute the fact that the vibration was obnoxious. The use of coconut mats as anti-vibrators was tried, but they were found wanting; therefore flexible beam supports of the type illustrated in fig. 1 were tried. The advantage of the beam lies in the fact that its length is easily adjustable and, therefore, the periodicity of the machine vibrating upon its support may be varied at will, until the vibrations of the floor are reduced to a minimum and cease to be annoying. It is not possible to cause vibrations to disappear absolutely, but they may usually be made inappreciable. The supports at each end as finally used (fig. 2) consisted of mascolite on the concrete; blocks of wood $\frac{1}{2}$ in. thick; iron plates $\frac{1}{2}$ in. thick, 16 in. long and 3 in. wide; and a rubber pad under a wood beam placed transversely under the bedplate.

During the experiments it was found that as soon as a flexible support was inserted, a large amount of vibration disappeared, but there were still perceptible beats even with only one machine running. With both machines on flexible supports and both running the vibrations ceased to be annoying, but there remained

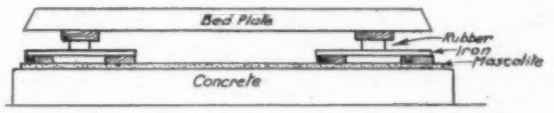

Fig. 2.—Details of Anti-Vibration Supports.

the problem of finding why there were beats when only one charging machine was running. Late at night after the machine had finished charging the battery it was noticed that there was still vibration in the rest room; then it was that the existence of the interrupter, previously mentioned, was revealed and investigations showed at once that the interrupter rack was vibrating very considerably. By inserting rubber washers between the bolt-heads and bedplate, between bedplate and iron rack, and between the nut and the iron rack, the vibrations were reduced. The second interrupter machine was separated entirely from the iron rack and supported upon a wooden erection placed upon coconut mats. This removed all vibration from the floor, and then with one charging machine and the interrupter running simultaneously no beats in the vibration were perceptible, and the remaining constant vibration from the charging machine was almost imperceptible; in order to feel it, one had to seek for it carefully. The interesting feature of the case was the amount of trouble caused by the relatively tiny machine.

The Electrical and Engineering Exhibits at Wembley.

Preliminary Notices.

(*Continued from p. 518.*)

Messrs. Cooke, Troughton & Simms, Ltd., are arranging a display of their surveying instruments and allied apparatus.

Messrs. George Kent, Ltd., are to show steam flow recorders, air meters, gas measuring and recording apparatus, coal meters, manometers, &c.

Messrs. W. H. Allen, Sons & Co., Ltd. (Bedford), will show a 320-b.h.p. Diesel engine, a steam-engine coupled to a d.c. generator, a "Compactum" air ejector, boiler-feed pumps, and other machinery.

The Brush Electrical Engineering Co., Ltd. (Loughborough), is arranging an exhibit showing the construction of the Brush-Ljungström turbo-generator, a "Brush-Delas" ejector, induction motors, transformers, &c.

Sir W. H. Bailey & Co., Ltd. (Salford), are to show steam pumps, air compressors, steam valves, a turret clock, pressure gauges, and other instruments.

Messrs. Petters, Ltd. (Yeovil), propose to exhibit oil engines of many types—marine, horizontal, and vertical—as well as generating sets.

Messrs. Nalder Bros. & Thompson, Ltd., intend to display electrical measuring instruments of all kinds—voltmeters, power-factor meters, ammeters, instrument transformers, and protective relays, as well as circuit breakers and automatic switches.

Messrs. I. Calvete, Ltd., will show electro-medical appliances and electrical equipment for hairdressers, including h.f. apparatus, vibrators, radiant lamp equipment, &c.

The Metropolitan-Vickers Electrical Co., Ltd., is showing an M.-V.-Ratean impulse type turbine of 14,000 kW capacity; a 1,000-kW turbine with double-helical gears for mill driving; a model showing the company's system of turbo-alternator ventilation; a motor-driven colliery winding equipment in operation; a complete automatic sub-station in operation; motors, transformers; circuit breakers; motor con-

trollers; radio apparatus; domestic appliances; an electric locomotive (in the South African Pavilion), &c.

THE VARIABLE SPEED GEAR, LTD., will show hydraulic variable speed gears and variable oil delivery pumps. The machinery to be shown will include a capstan, steering gear, &c.

THE MORGAN CRUCIBLE CO., LTD., is to have a collection of crucibles, clay refractories, carbon brushes, and electrical apparatus.

MESSRS. MAVOR & COULSON, LTD. (Glasgow), are arranging a display of coal-cutters, conveyors, hauling gear, and switchgear. They are also supplying equipment for the demonstration mine.

MESSRS. JOSEPH L. THOMPSON & SONS, LTD. (Sunderland), are to show models of three vessels which they have recently constructed.

THE IOCO RUBBER & WATERPROOFING CO., LTD. (Glasgow), will exhibit examples of insulating materials, including cloth, tapes, and synthetic resins, and manufactured parts.

MESSRS. WILLIAMS & JAMES (Gloucester) are to exhibit a 1.2-kW generating set consisting of a d.c. generator driven by a two-stroke engine, and a motor-driven air compressor.

MESSRS. GLENFIELD & KENNEDY, LTD. (Kilmarnock), intend to display water meters, boiler-feed meters, water-level indicators and recorders, hydraulic valves, steam valves, fire-extinguishing plant, &c.

MESSRS. A. REYROLLE & CO., LTD. (Hebburn-on-Tyne), are to show a typical control panel, weighing 23 tons, for large power units, as well as a representative range of switchgear for industrial, mining, and domestic service.

MESSRS. BELLING & CO.'s exhibit will comprise electric fires of many patterns, cookers, water heaters, irons, and "M.K." electrical accessories.

EBONESTOS INSULATORS, LTD., is arranging a collection of its insulating fittings for electrical and radiq work.

MESSRS. RICHARD GARRETT & SONS, LTD., are to show a 6-ton steam wagon and a 175-kW generating plant consisting of a 225-b.h.p. superheated steam engine coupled to an English Electric generator.

MESSRS. W. H. WILLCOX & CO., LTD., will have on view samples of their wire-bound hose-pipe, tanned-leather belting, "Balatite" belting, asbestos-fibre sheeting, pump packings, &c., as well as oil filters and purifiers, the "Penberthy" automatic cellar drainer, pumps, &c.

MESSRS. YARROW & CO. (1922), LTD., are to exhibit a large scale model land-type boiler, a model marine boiler, fitted for oil burning, and a number of model boats.

(To be continued.)

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

"The Lordly Shannon."

Here in Ireland we have recently heard many opinions expressed for and against the proposed Shannon scheme, but none of these have got us much nearer the actual facts.

From your remarks in last week's issue, you apparently have reliable figures at your disposal, and it would be interesting if you would kindly publish answers to two queries: (1) What is the estimated maximum *continual* output if 10,000 million cu. ft. of storage were available; and (2) what is the estimated maximum *continual* output if no storage were available?

Owing to the extraordinary difference between the maximum and the minimum flows, "average annual output" is rather a misleading term when a more or less continual demand has to be met.

It would not be out of place among the other topsy-turvey items if a clause was inserted assuring Messrs. Siemens-Schuckert that the industrial electricity consumers in the Free State would be prepared to take long holidays every summer when the Lordly Shannon runs low or at least that they would oblige by accommodating their demand to the available supply of water.

What a beautiful graceful load curve would result from such an arrangement!

J. Murphy.

Bandon, *March 22nd*, 1924.

[Our correspondent is referred to the series of papers read by Mr. Chaloner Smith before the Institution of Civil Engineers of Ireland, and published in the *Journal* of the Institution. He will find also in Vol. XLVII of the *Journal* an interesting discussion of the Report of the Board of Trade on the Water-Power Resources of Ireland. The Sub-committee which investigated the rivers of Ireland, so far as a miserable £2,000 allowed, reported that 10,000 million cu. ft. storage would give an *average annual output* of 52,500 electric h.p. with an installed plant of 65,900 h.p. Mr. Murphy is quite correct in stating that such a figure is misleading, as it gives no indication of the *minimum* output over any part of even the *average* year, and the commercial value of an isolated undertaking must be gauged largely by the minimum output in the driest period of the driest year.

Without regulation by storage, Mr. Chaloner Smith shows that 52,000 b.h.p. might be obtained for 15.6 per cent. of the year on the basis of a 25 years' average, and for 4.12 per cent. on the basis of the very dry year 1903, in both cases after reserving 1,500 cusecs for fisheries. If no reservation were made the *minimum* output would be increased somewhat.

Mr. Chaloner Smith estimated that the storage proposals of the Board of Trade Sub-Committee were entirely inadequate for anything approaching control of the river.—EDS. ELEC. REV.]

Single-phase Induction Motors and the Starting Problem.

The correspondence upon this subject has been interesting. Notwithstanding Mr. Brittain's opening remarks in his letter of the 11th inst., the whole of it referred almost exclusively to automatic centrifugal clutches.

Apparently what Mr. Brittain requires is an automatic clutch designed not to come into operation until a single-phase squirrel-cage motor has reached a minimum of 90 per cent. of its full speed.

Such a clutch, with the additional advantages of being capable of control up to 95 per cent. of full-load speed, is already to be found in the "Lydall" clutch, for which I have applied for letters patent, and which is made by my firm.

Perhaps the following figures taken from a recent test on a 9-in. "Lydall" clutch pulley supplied to Messrs. E. Brook, Ltd., Empress Works, Huddersfield, and fitted to single-phase squirrel-cage motors, will be not only interesting, but convincing.

The full-load speed of the motors was 1,150 r.p.m., and the clutch was *entirely free* until the motor reached 1,135 r.p.m., when the shoes came into operation, taking up the full load within about 15 seconds, which period Mr. Brittain will doubtless admit allows sufficient time for the starter to be changed from "starting" to "running" position.

The following schedule taken from tests on numerous "Lydall" clutches fitted to single-phase motors will add to the above:—

Full-Load Motor Speed.	*"Lydall" Clutch Operating Speed.*
1,410	1,385
930	895
715	688

These speeds are unique in the history of automatic centrifugal clutches, and I venture to suggest that they cannot be approached by any other type. Messrs. Centrifugal Clutches, Limited, are prepared to guarantee specific performance with any they supply.

M. Lydall,
Managing Director,
Centrifugal Clutches, Limited.

Huddersfield, *March 25th*, 1924.

A Potential Problem.

Have not some of your correspondents rather darkened counsel by unnecessary complication?

I should say the simple answer is this:—

In any conductive circuit the e.m.f. and the potential drop due to current through resistance are equal and opposite in direction. In the ring circuit propounded the e.m.f. is uniform around the circuit, the potential drop also uniform around the circuit, consequently they cancel out and no potential difference can be detected between any two points.

If the ring were not of uniform section (rather conductivity) all round, the segments of higher resistance would show a potential difference in opposite direction to the e.m.f. and those of lower resistance a potential difference in the same direction as the e.m.f.

Henry M. Sayers.

London, *March 30th*, 1924.

Bankruptcy.

I am very interested in the correspondence under the above heading. For years past I have been of opinion that the law relating to bankruptcy is somewhat at fault.

There seems to be two classes of bankrupts, *viz.*, the limited liability company and the private trader.

It would, in some cases, be very difficult to subsidise a debit balance of a large company, inasmuch as it so often happens that the causes of failure are over-capitalisation, mismanagement, depreciation, and many other things of such a kind that financial help would be of little assistance to the future of the company.

With regard to the second and more frequent class of bankrupt, a man or a private company in a small way of business, through illness, slackness of trade, bad debts, or long overdue accounts, may, and certainly often does, get pounced upon by, say, one or two creditors for a comparatively small

debt. Judgment is given against him and this fact is recorded in trade journals, &c. The only course open to such a man is bankruptcy. All his creditors must then suffer perhaps total loss, while he himself suffers total ruin. Is this fair either to the creditors or to the man?

The writer knows of several cases where liabilities have been under £500, but there have been no assets, and all that money has been lost because while at the moment of filing his petition he could have paid, say, 5s. to 10s., legal expenses, unfinished work, and other causes have sunk the whole of the assets.

Now if that man was willing to pay, and was perfectly honest, and could be helped either by cash assistance or by "stay" of judgment, I am of opinion that 20s. in the pound would be paid later instead of—as in many cases—nil.

It must be borne in mind that such a man or company would have to submit to examination, but of a private nature, and would have to enter into some agreement with the guarantors to discharge his debt and to manage his business on lines set out by them. In other words, they would become his "private" trustees, and I would suggest that he should take out a personal insurance policy on his life to cover his guaranteed amount. This may all seem crude and unbusiness-like to some of your readers, but please comment.

Watchful.

March 23rd, 1924.

Wiring in a Corrosive Atmosphere.

Having had over 10 years' experience in charge of installations in chemical works of some magnitude, I naturally feel myself in sympathy with "H. A. D."; it is extremely difficult to meet the terrible conditions which arise.

Your correspondent "H. W." states that "one is forced, after many years' experience, to the conclusion that there are establishments wherein the conditions preclude the idea of real permanency with the materials at present at our disposal."

With regard to this, I wish to mention for the benefit of those who, like myself, have been up against the chemical problem, that a cable is now coming on the market different from anything else we have yet had, and the possibilities are that, even in the worst conditions, this cable will stand for a matter of 20 years.

As this is an extremely long period for a chemical establishment to stand, one can readily believe that as far as the building is concerned this cable can be called permanent cable.

The cable I have in mind is ebonite-sheathed, and the problem of boxes has been very satisfactorily solved. The system has the appearance, and to some extent the mechanical advantages, of the conduit system, while being otherwise absolutely corrosion-proof, fume-tight, and water-tight.

Up to the present I believe only one or two installations have been put in, with a view to exhaustive tests, and after two years, subject to the most strenuous conditions with both alkalis and acids, strong and weak, the installations are as good to-day as the day they were put in, and the insulation resistance is invariably infinity.

A system which can produce such results as this certainly requires the consideration of all engineers engaged in works of a chemical nature.

Omega.

Manchester, *March 26th*, 1924.

Having read your correspondence on installations in a corrosive atmosphere, I should like to say, as an electrician at works where acids, alkalis, sulphides, &c., are used in large quantities, that installations in conduit, cleat wiring in v.i.r., and cab tire cable are a failure.

The only cable which I have found to stand up to conditions of this class is the ebonite-sheathed cable made by the Helsby company. This cable, which is ¼ in. in cross section and can be had in two or three core, each with a section of 3/.029, is the ideal for such corrosive atmospheres. The boxes used with this cable are very neat, water and fume-tight, some of which are placed directly over boiling vats of chemicals.

The insulation test of such a circuit, which has been at work for some two years, is within the range of 20 megohms to infinity. The switches, lampholders, and distribution boards are equally safe under the same conditions. I have examined the interior of the fuse and junction boxes periodically and have failed to find any sign of chemical action on the brass or copper interiors. The erection of this installation is exceedingly simple and neat, and the time taken in erection is about 50 per cent. of that of conduit.

For my own part, where chemical conditions abound, I would never again consider the other systems mentioned, especially from a maintenance point of view, as I have never yet had a single fuse blown, either from short circuit or leakage, &c. This, I think, is very good, considering I am working on a 240-volt circuit, earthed neutral. I also use the three-core cable for small motors up to 3 h.p. on a 400-volt a.c. supply.

F. D.

Manchester, *March 27th*, 1924.

I have read with interest the correspondence which was opened by your correspondent "H. A. D." Mr. Pearce, in this week's issue, states that the running of C.T.S. cable on porcelain cleats is to be discouraged owing to the trouble caused by pressure on the sheathing. He goes on to say that the only way to support C.T.S. cables is by passing the cable round porcelain bobbins, but my own experience over a long period is that the remedy will prove much worse than the original fault. I have certainly found cases where the sheathing has been sheared due to the sharp edges of the cleats; this fault is not, however, a cable fault but one entirely due to the wrong type of cleat being used. If Mr. Pearce will use a cleat properly designed for carrying C.T.S. cables, I can assure him that he will not get a repetition of the trouble which he appears to have had.

Another statement which he makes without, I think, giving serious consideration to it, is that one should use a heavy cast-iron box with stuffing glands for C.T.S. cable, but he does not tell us how we are to comply with the regulations, as isolated metal parts in a system must be earthed.

Personally I am all against earthed connections of this nature, which are more of a snare and a delusion than a safeguard, as they are in the majority of cases never there when a fault takes place.

Another statement which he makes without, I think, giving metal boxes in chemical works and such-like places are not altogether satisfactory; while these can be protected externally from corrosion by periodical painting, the interior is always liable to sweat "unless same is filled solid," with the result that the terminals and cable ends will ultimately give trouble.

Hadsome.

March 29th, 1924.

Dover Electricity Committee and Electrical Contractors.

My attention has been drawn to the report of the meeting of the Dover Electricity Committee held on March 3rd, when the recent Electrical Exhibition was discussed, as remarks reported to have been made by several councillors would, if allowed to pass unchallenged, reflect seriously on the loyalty of the local contractors towards our electricity undertaking.

In particular, the remark by a certain councillor that: "Before the contractors grumble, they should have expressed their willingness to help," is both prejudiced and misleading.

As honorary secretary of the East Kent Branch of the Electrical Contractors' Association, I have the honour to represent the majority of the leading contractors in this area, and on January 31st I wrote to the chief engineer asking him to call a meeting of the leading contractors in Dover and representatives of any wholesale firms who were exhibiting, "so that we could arrange to meet your wishes as to the way you want matters pushed." In addition to this, as a private contractor, I made personal application for space for my own exhibit and offered to pay for it, but was told that this could not be allowed, as only manufacturers would be invited to exhibit.

The remark attributed to another councillor that "he hoped that the contractors had learnt a lesson and would in future co-operate with the Electricity Committee," is as unjustifiable as the remark referred to above. The contractors were not only willing to co-operate with the Electricity Committee, but were anxious to do so.

It is to be feared that these unfair insinuations against local contractors are merely propaganda for the purpose of assisting the scheme of certain parties to establish municipal showrooms in Dover.

The contractors in this town have hitherto always received fair and friendly treatment from all the officials of the Electricity Department, and it certainly seems a pity that certain councillors should try to upset these pleasant relations.

Arthur Pinto, A.M.I.E.E.,
Hon. Secretary, East Kent Branch,
Electrical Contractors Association (Inc.)

Dover, *March 26th*, 1924.

Plumbing Joints.

The reasons given by jointer-plumbers engaged on cable work for tallowing plumbs immediately the process of wiping is completed, may be summarised as follows:—1. Cleans the plumb and puts a good finish on it. 2. Makes the plumb sound because the tallow fills the pores in the plumb. 3. Makes the plumb sound because the tallow chills the outer skin and causes it to set quickly and hold the plumb in shape and position while the rest of the metal cools and sets.

The men who give reasons 1 and 2 do not know anything about the matter and probably tallow their wipes because they have been taught to do so or have seen others do so, but have not been taught the reason why and have not had sufficient interest to inquire further into the matter.

The men who give reason 3 are very close to the correct reason, and an observant jointer will draw attention to the appearance of two plumbs made from the same pot of metal, both having been tallowed. One will appear bright grey with a fine surface and a sheen on it; the other will appear dull and have a coarse surface. The jointer will explain that the

second plumb was handled too slowly and was allowed to get too cool before finishing and tallowing.

To thoroughly understand the matter it is necessary to make an investigation into the composition and behaviour of plumbing metal. Plumbing metal is a lead tin-alloy, and belongs to a class of alloys which show a duplex structure, *i.e.*, alloys in which the state of mutual solution of the two metals which exists when they are in the molten condition, is more or less completely broken up when they are solid. During cooling the predominating constituent crystallises out of the fusion until finally the remaining fluid portion, or mother liquor, becomes of a definite limiting composition, which is also reached at a definite limiting temperature. The mother liquor, known as the eutectic alloy, then solidifies. The resulting structure consists of crystals of the predominating metal embedded in the eutectic.

The eutectic mixture of tin and lead consists of about 65 per cent. tin and 35 per cent. lead and its melting temperature is about 340 deg. F. The plumbing metal used for cable jointing work generally consists of 35 per cent. tin and 65 per cent. lead, and its melting temperature is about 440 deg. F.

When making a plumb the jointer pours metal on to the joint until he has a mass of plastic metal built up of such a size as experience tells him will make the plumb. This mass of metal he quickly works up into shape with his cloth. The eutectic alloy in the mixture tends to drain to the bottom of the wipe and form a blob of so-called tin. The last operation of the jointer is to bring this blob over to the top of the plumb and before it can drain through to the bottom again he flushes the plumb with tallow, which chills the outer skin and sets the eutectic. The sudden cooling of the outer skin also causes a shrinkage which tends to close any voids formed between the crystals in the body of the plumb through the earlier draining of the eutectic to the bottom.

A properly made and finished plumb appears a bright grey colour with a fine texture owing to the eutectic alloy on the surface, and plumbs of this class will rarely prove porous or crack. A dull coarse surface on the plumb is evidence that the metal is too coarse, or that the plumb has not been worked quickly enough, and that the eutectic alloy has been allowed to drain to the bottom of the plumb and probably had been drawn off or wiped away in the process of finishing. Plumbs of this class are generally porous.

F. J. B.

March 28th, 1924.

Prospects in New Zealand.

I have just read the letter on the above subject penned over the signature of Mr. Nelson Jones, of the National Electric Engineering Co., of Wellington, N.Z., in your issue of February 29th.

Your correspondent has adopted a highly controversial attitude which was not invited by any statement of mine. He also throws out a number of sentences which are obviously innuendos referring to my personal engineering capability. In this case, however, the cap does not fit, for during my period of residence in N.Z. I never had any difficulty in obtaining, *and holding*, employment, about 50 per cent. of it being on the technical side; and I left N.Z. considerably better off than when I arrived there. I can therefore afford to disregard his suggestions as unworthy of discussion in a technical journal.

I must, however, beg leave to trespass a little further on your space, in order to reiterate one or two points on which Mr. Nelson Jones has flatly contradicted me and made it appear that I have some object in deliberately discouraging intending immigrants.

The first point of importance is in connection with the employment situation in Wellington last winter. Mr. Jones is singularly out of touch with realities if he did not "hear of any electrical workers being out of employment," for I know that his own company "laid off" several men, as did almost all the other contractors. A little correspondence with the Secretary of the Wellington Electrical Workers' Union would prove that I have not over-estimated the position. Probably also the Secretary could give an estimate of the number of times men called at Mr. Jones's office on Jervois Quay asking for employment, but their applications, unfortunately, were not brought to the notice of Mr. Jones.

Your correspondent, everyone will agree, scores a wonderful hit, when he corrects me for saying "several universities," where I should have said "several university colleges."

Now with regard to the statements emanating from the High Commissioner's Office, first, it must be understood that the information clerks, and in fact more than 90 per cent. of the officials, are persons who have never been near N.Z. except on the map. Plainly they are not qualified persons to give practical information, and, in addition, what layman, except an experienced engineering employment manager, knows the difference between a "competent electrician," a "wireman" pure and simple, and an elevator (electric) erector? There is a considerable variety of men who describe themselves as "qualified electricians," rightly, and the High Commissioner's officials are not sufficiently well-informed to be able to question a man closely.

With regard to "post-hole" digging, which Mr. Jones apparently regards in a humorous light, I would explain that it is not the rule in N.Z. to employ labourers to attend to any navvying, concrete drilling, or similar work required for installation. The electricians do it themselves, and if an immigrant is one of the party he generally gets most of this to do, which makes him wonder "where's he's at."

Of course, Mr. Jones's R.E. friends whom he nominated, are delighted. They have had a very useful "pull" to assist them in obtaining employment whilst others were out of work.

The cost of living in N.Z. is lower than in England, says Mr. Jones. This may be so in Mr. Jones's individual case, but I was writing for the benefit of, and from the point of view of, a person newly arrived in the country. A cheap way to live is to pay 30s. per week for a furnished room and kitchenette, £9 for a suit of clothes which wears threadbare in two months, and 35s. for a pair of paper shoes, very suitable for a damp climate. Working men will agree with me here, I am sure.

Mr. Jones is correct about the food being cheaper, and as regards dairy products, they are absolutely the finest in the world. Meat is extremely cheap, but like g.p. compared with that which is frozen and exported to England. Perhaps the freezing makes it more tender!

As I said previously, a minimum wage is fixed by law, and I reiterate that very few firms pay over the minimum. 25 per cent. of the *permanent staff* of wiremen at Mr. Jones's Wellington branch would work out to something less than 3, I think—old hands, who naturally are entitled to privilege in the way of slightly over the minimum wages. Mr. Jones should be in a better position than I to state the actual wage in £ s. d., but he does not do so.

Membership of a trade union is compulsory, I said; well, perhaps a terminological inexactitude. The actual position is this: If any employer hires a non-union workman, the local secretary can immediately, and legally, cause that man to be discharged, unless he joins the Union within seven days.

The secretary, naturally, must use his power on every occasion, but does any unionist think that a union built upon the shifting sands of Government protection has any power in dispute with the interests which control that Government?

Mr. Jones very airily dismisses the subject of Government strike-breaking. The New Zealand method may appeal to all thinking men of his interests, but it did not appeal to the travelling public, when during a marine strike, the ships were undermanned by crews of "anybodies" so utterly unskilled in seamanship as to make the ships overdue on every run. This was a result of the Government suspension of the provisions of the Shipping Acts.

Mr. Jones says licence examinations are held bi-monthly. In Christchurch, maybe, but they *are annual* in Wellington, which is the capital city, and the point a new arrival naturally makes for.

Mr. Jones refers to the "It's-done-in-England-this-way" man. This particularly obnoxious Anglo-Saxon type, the "Englishman abroad," is really not so common as foreign cartoonists and Mr. Jones would have us believe. I was not thinking of that type of man at all.

I am sure, Sir, that you will feel that this correspondence has now served its purpose. "Diverter" and others interested have heard both sides of the case: one side presented by a fairly well qualified (if I may say so) electrical working man who was no failure in New Zealand and who has absolutely no axe to grind; the other side presented by a man probably better qualified technically, but obviously representing those who are interested in the maintenance of a constant surplus of skilled labour at the lowest possible cost.

If "Diverter" and others are determined to go and try their luck, let them obtain a written guarantee of one year's steady electrical employment from Mr. Jones before he leaves England. Will Mr. Jones come up to the scratch?

"Diverter" has written me privately, and it appears that he is a real "electrician," thoroughly familiar with machines and plant work. I doubt very much if he is the type of man who would be satisfied with a constant round of screwed-conduit wiring.

Finally, Mr. Jones finished in the regular Maorilander's characteristic style: "New Zealand *is* the finest country in the world," and I agree, but I am not disposed to enter a further controversy as to in what particular respects.

Inductor.

San Francisco, U.S.A., *March 16th*, 1924.

Enham Village Centre.

Our attention has been called to your article on the "Enham Village Centre," which appears in your publication of March 21st, where you state in the last paragraph that "the whole of the electrical and other engineering work in connection with the new factory was carried out by Messrs. Baxter and Caunter, Ltd."

We would like, in order to remove any misunderstanding in the trade, to correct this statement by stating that we were merely acting as suppliers of plant, machinery and material, whilst the erection, fixing, wiring, &c., was carried out by the contractor.

We should be glad if you would make this known in your next issue.

Baxter & Caunter, Ltd.
G. W. Kettlewell, Director.

Reviews.

The Atom and the Bohr Theory of its Structure. By H. A. Kramers and H. Holst. Pp. xiii + 210. Figs. 34. Two charts. London: Gyldendal. Price 10s. 6d. net.

The reader who desires to gain some knowledge of the revolutionary changes that are now proceeding in scientific thought concerning the nature of radiation and the structure of matter, has now so many books to choose from, that he must find it rather difficult to know how to decide between them. Books have been published graded to every class of reader, from the class that is animated by idle curiosity alone, to that which seeks a thorough grasp of the principles concerned; with cross divisions according to the amount of experimental detail they consider expedient or desirable. The present example is a Danish work, translated by Mr. and Mrs. Lindsay, and introduced, with a few commendatory words, by Sir Ernest Rutherford, F.R.S. Probably the most useful part to be played by a reviewer is to give the public such a description of the book as to enable the individual inquirer to gauge just how far it is suited to his requirements. This is an elementary presentation of the subject designed to meet the needs of those who wish to keep abreast of modern developments in science, but have neither the time nor the inclination to embark upon the highly mathematical and abstract reasoning in which these developments have generally to be couched. Consequently, there are no symbols of integration, and no differential equations to be encountered, anywhere in the book. Indeed, there are no equations at all, except in so far as a given quantity, such as ν, the frequency of periodic movement, may be expressed in terms of other quantities, in order to exhibit the felicities of the Bohr hypothesis in explaining phenomena. Again, in this book the subject is approached from the platform of accepted science, the general principles of which may be expected to be familiar to any reader who nourishes an ambition to become acquainted with the new theories concerning the structure of an atom. Thereafter the development of these theories is entered upon on strictly historical lines, and the reader is made to see how, step by step, through the relentless logic imposed by observed facts, the originators of these theories were driven to evolve novel hypotheses repugnant to classical mechanics. Dr. Kramers is particularly well qualified to make this clear, for he was a valued assistant to Professor Bohr in developing the theories of the latter, as well as a contributor of original communications to this branch of knowledge. Thus before we come to the Bohr theory of the hydrogen spectrum and the implications of that theory, we have chapters on "Atoms and molecules," on "Atoms and electrons," and on "Light waves and the spectrum."

These self-imposed limitations that the authors adopt involve corresponding drawbacks, and they have felt themselves debarred from making their readers acquainted with some of the abstract generalisations which, once grasped, serve to unify solutions of the problems they treat. There is, for example, no attempt to present Planck's constant as a constant of *action*. Some of the difficulties of the subject are, however, attacked with great ingenuity and success. We have met with no other book in which the complexities of Bohr's *correspondence principle* are so cleverly adumbrated, and the same commendation applies, equally, to the way in which the need of introducing more than one quantum number, is brought home to the reader. The last chapter deals with chemical properties of the elements as interpreted by atomic structure, and the book ends with a useful list of symbols commonly employed in connection with this branch of science together with their meanings and the numerical values of the constants made use of. On the whole, this book is one that is likely to meet the needs of most of the people who wish to acquaint themselves with the subjects it treats of.

Principles and Practice of Telephony. By Jay G. Mitchell, M.Am.I.E.E. Five volumes. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. per volume.

This work, of which three of the five volumes are to hand, is the outcome of a course of articles on Telephony which originally appeared in serial form in *Telephony*, and is intended to provide those engaged in telephone work with a means of acquiring a thorough knowledge of principles irrespective of the extent to which their previous acquaintance with the subject may have gone.

Volume I deals with principles and apparatus and includes chapters on units, magnetism, sound, telephone transmitter and receiver, induction coil, magneto generator, the telephone circuit, alternating currents, common battery operation, relays, &c. Volume II treats of the line, cord circuit, operator's equipment, circuit efficiency, power plant, &c.; and Volume III of the toll switchboard, toll equipment, toll trunking, associated toll equipment, graphic methods, nature and laws of telephone traffic, &c.

In the treatment of fundamental principles the author's explanations and definitions should be easily grasped by those who have but the most rudimentary knowledge of electricity and magnetism. They are clearly put, although at times lacking in completeness or precision of statement. The "Ohm," for example, which is stated to be the resistance offered to the passage of a current by a column of mercury 106.3 cm. long, having a uniform cross-sectional area of 1 sq. mm., is meaningless unless it be qualified by adding that the temperature must be 0°C.

There are a number of Americanisms throughout the book which will be somewhat unfamiliar to British readers, and in most cases the diagrams of apparatus are too small to enable the descriptions to be conveniently followed, although exceedingly neatly executed.

The work, as a whole, is an eminently practical one, and should prove of real service to those who desire to obtain a working knowledge of modern telephone systems and their methods of operation.

The Use of Light in Modern Advertising.

A DISCUSSION on the above subject took place before the Illuminating Engineering Society on March 21st, Mr. J. Eck presiding. Introductory papers were read by Miss M. Partridge and Mr. G. P. Garbett.

Miss Partridge remarked that the best and most paying form of advertising was, for the majority of shops, the well dressed and well lighted shop window. There was, however, some difference of opinion as to what constituted a well-lighted window. It was easier to explain what it was not than what it was. Miss Partridge mentioned three cases where difficulty had been found in inducing the owner to adopt concealed lighting. One was a general electrician's shop window, and the author remarked that she could not recall any electrician's window that was really well dressed and well lighted; in most cases there was an overcrowded display of fittings, and too many of them lighted up. The two main points were that the source of light should be concealed, and there should be sufficient sources to prevent irritating shadows. The amount of light strictly necessary varied according to circumstances (for instance, the contents of the window), but ranged from 0.5 to 2 c.p. per cubic foot of space. Effective use could be made of coloured light, and drapers' shops should install colour-matching light. One reason why such lamps were not widely used was perhaps because a room lighted only by daylight made customers look plain.

Miss Partridge then turned to the subject of illuminated signs, and remarked that the English did not spend so much time out of doors as Frenchmen; this accounted partly for the less general use of illuminated signs. Describing the installation of the neon signs, Miss Partridge said that problems of construction and erection were often tricky. Elaborate glass letters, operated at 15,000 volts, had to be handled with care during erection on high roofs, and protection had to be very thorough. The true neon incandescence was a vivid orange, but the presence of impurities might give rise to blue, lavender, violet, and other shades of colour.

Mr. G. P. Garbett said that the fact that in forty years no fundamental change in principle had been recorded was a tribute to the early pioneers in this field. But the advent of electric signs gave rise to many objections, which modified the designs; in America the absence of any restrictions caused development to take a different path. In this country the tendency had been to avoid startling effects and to rely on colour-changes, &c., to attract attention. In America, where commercialism held undisputed sway, each sign vied with its predecessor in the race for "bigness," and the chief feature was the amount of "punch" that could be put into a sign.

Mr. Garbett then traced the improvements that had been made in the design of the letter sign, pointing out the advantages of the modern sheet-steel channel section letter, which ensured good legibility and could be read at a wide angle. The metal-filament lamp gave a great impetus to signs, especially as the speed with which it could be lighted and extinguished enabled "animated" effects to be produced, such as could not be achieved with the carbon-filament lamp. Reliability was much more important than high efficiency in lamps used for signs; the failure of one or more lamps might completely change a letter besides having a most disfiguring effect. In America tables and equations had been derived to determine the size of lamps used in different circumstances; but in view of the many varying factors, hard and fast rules could not be applied. Colour was an important asset and tinted glass hoods which could be fitted over lamps were becoming common. The new spray-enamelled lamps would be watched with interest, but it appeared that the enamel coating had a material absorption effect.

In the next section of his paper Mr. Garbett explained the principles governing various forms of animated signs, and showed attractive lantern slides of some of the latest designs in this country and abroad. He also dwelt in some detail on the complexity of the regulations imposed by local authorities, varying greatly in different localities and sometimes in conflict with one another. It was in the public interest that some measure of control should be maintained over the erection of signs in streets; but the various conflicting regulations should be scrapped and a unified set of by-laws substituted.

E

Business Notes.

Bankruptcy Proceedings.—Hudson's Electrical Engineering Co., Prudential Buildings, 20, Park Row, Leeds, electrical engineers.—The receiving order in this matter was made on February 15th on a creditor's petition. The statement of affairs shows liabilities of £1,346 and there are no assets. The first meeting of the creditors was held on March 13th at the Official Receiver's office, 24, Bond Street, Leeds, when the case being a summary one was left with the Official Receiver as trustee of the estate. The following are the principal creditors:—

	£		£
Lefebvre, A.	240	Leach, S. G., & Co., Ltd. ...	18
Holman, Arthur	145	Smith, Alfred, Ltd.	25
Berry, F. L.	100	Veritys, Ltd.	25
Harwood, H. A.	123	Wood, Sarah	32
Brown, J. E.	223	Gilbert Co.	28
Enfield Cable Co., Ltd.	100	Viennese Electric Lamp Works,	
Tate, Jas.	49	Ltd.	28
Springfield Electric Co.	49	McCulloch & Hewitt	20

G. F. Neal, electrical engineer, 5, Smallgate, Beccles.—Receiving order made on March 22nd, on debtor's petition.

R. Rudd, electrical engineer, Long Ashton, Somerset.—First and final dividend of 5s. 3d. in the £, payable at the Official Receiver's office, 26, Baldwin Street, Bristol.

F. H. Dennis, electrical engineer, 20, High Street, Chelmsford.—Trustee, Mr. T. Gourlay, official receiver, 29, Russell Square, W.C.1., released March 3rd.

F. Rawcliffe (F. Rawcliffe & Co.), electrical engineer, 8, Nun Street, Newcastle-on-Tyne.—Trustee, Mr. C. Wollett, official receiver, 4, Northumberland Street, Newcastle-on-Tyne, released March 10th.

T. Scott & J. Campbell (T. Scott & Co.), wholesale electrical suppliers, 42, Handyside's Arcade, Percy Street, Newcastle-on-Tyne. Trustee, Mr. W. Brittain, 4, Northumberland Street, Newcastle-on-Tyne, released February 6th.

F. L. Perrin, electrical engineer, 57, Wellingborough Road, and 5, College Street, Northampton. Trustee, Mr. H. C. Palmer, Kingham Chambers, Abington Street, Northampton, released February 22nd.

A. T. Williams & W. J. Bevan (Electrical & General Engineering Co.), electrical engineers, 49, Commercial Street, Aberdare.—Last day for proofs for dividend April 14th. Trustee: Mr. E. Owen, official receiver, 34, Park Place, Cardiff.

J. Bakewell, electric light and power engineer, 43, Waterside Road, Barton-on-Humber.—Second and final dividend of 17s. 10½d. in the £ and 4 per cent. interest, payable at the Official Receiver's office, St. Mary's Chambers, Great Grimsby.

Company Liquidations.—Indicators, Ltd.—Mr. G. O. Pepys, official receiver, has issued a report to the creditors and shareholders. The accounts show unsecured claims amounting to £8,074; fully secured creditors for £4,852, the security being valued at £10,000; and preferential debts, £914. The assets are valued at £6,142, a deficiency of £2,486, and a total deficiency of £44,392 with regard to contributories, the issued capital being £41,546. The report states that in May, 1919, a private company was formed to acquire patent rights and other interests relating to electrical advertising devices. The two principal promoters were Paul Henry Waller and Bernard Samuel Nordman. The present company was formed in October, 1921, with a nominal capital of £70,000, and a number of contracts had been entered into, several of which remained uncompleted. The failure is attributed by Waller to lack of working capital throughout the company's existence, and the failure to carry through a scheme of reorganisation in 1922. Mr. R. G. Pye, 26, Budge Row, E.C., has been appointed liquidator of the company with a committee of inspection.

Uni-Directional Apparatus Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by Aaron Barnett, electrical engineer, 269, Mile End Road, E., creditor, and will be heard in London on April 8th.

New Rottingdean Electricity Co., Ltd.—Winding up voluntarily. Liquidator: Mr. H. B. C. Baldwin, 8, North Street, Brighton. Meeting of creditors at the Liquidator's offices April 3rd.

Aucklands Wireless, Ltd.—Winding up voluntarily. Liquidator: Mr. F. G. Jenkins, 5, Philpot Lane, E.C. Meeting of creditors April 7th, at the Manchester Hotel, Aldersgate Street, E.C.

Farndons Power & General Electrical Co., Ltd.—A meeting of creditors was called for March 29th, at the office of Messrs. Galloway, Stone & Co., 47, Temple Row, Birmingham.

North Melbourne Electric Tramways & Lighting Co., Ltd.—A meeting of members is called for April 30th, at 9, Cloak Lane, E.C., to hear an account of the winding-up from the Liquidator, Mr. H. W. Stacey.

Frank Craft (Castleford), Ltd. Liquidator: Mr. C. T. Appleby (with a committee of inspection), 155, Norfolk Street, Sheffield, appointed March 5th.

Metropolitan Electric Wire Co., Ltd.—In the High Court, on March 26th, Mr. Justice Eve, on the petition of H. C. Rowland & Co., Ltd., made an order for the winding up of the Metropolitan Electric Wire Co., Ltd. The petition was not opposed.

Private Arrangements.—J. Holbrook & Co., builders and contractors, 1-2, Foster Lane, London, E.C., and Queen's Road, Dalston, London, E.—A largely attended meeting of the creditors of the above was held on March 21st, at the Cannon Street Hotel, London, E.C., when a statement of affairs was presented which showed liabilities of £8,134. After allowing £250 for preferential claims, the assets were estimated to realise £3,770, or a deficiency of £4,124. An offer was made of a composition of 10s. in the £, payable by instalments spread over 18 months, and it was stated that there were people interested in the electrical department of the business who would assist with a view to a limited company being formed to acquire that section of the concern. The proposal was that the stock, fixtures, fittings and goodwill of the electrical business should be disposed of to the company. After a short discussion a resolution was passed in favour of a deed of assignment being executed with Mr. A. E. Quaife, of Messrs. Westacott, Quaife & Co., I.A., of 155, Fenchurch Street, E.C., as trustee, together with a committee of five of the principal creditors. The trustee and committee were authorised to accept a composition of 10s. in the £, satisfactorily secured.

The following are among the creditors:—

	£		£
Croggon & Co., Ltd.	177	India-Rubber, Gutta-Percha, and	
City Electrical Co., Ltd. ...	11	Telegraph Works Co., Ltd.	10
Simplex Conduits, Ltd.	32	Sloan Electrical Co.	29
Burndept, Ltd.	42	Sterling Telephone and Electric	
Swift Electrical Co.	10	Co., Ltd.	15
Southwark Elec. Co., Ltd. ...	18	Supra Electrical Co., Ltd. ...	15
Power Equipment Co., Ltd. ...	11	British Thomson-Houston Co.,	
Jones & Pordes, Ltd.	10	Ltd.	50
Sun Electrical Co., Ltd. ...	66	Falk, Stadelmann & Co., Ltd.	84
Wireless Experts, Ltd.	19	National Electrical Supplies ...	85
London Electric Stores, Ltd. ...	24	Siemens Bros. & Co., Ltd. ...	10
General Electric Co., Ltd. ...	33	Metropolitan-Vickers Electrical	
Yeurah Electric Co.	17	Co., Ltd.	22
Eons Wireless Supply Co. ...	10	Shenton & Co., Ltd.	10
Marconi's Wireless Telegraph		Edison Swan Electric Co., Ltd.	67
Co., Ltd.	48	London Electrical Co.	138

Isle & Jarrett, 28, Hall Gate, Doncaster, electrical engineers.—A meeting of the creditors herein was held on March 21st, when a statement of affairs was submitted which disclosed liabilities of £1,949, of which £1,459 was due to unsecured creditors. There were loan creditors for £225 and a bank overdraft of £266. The net assets, subject to realisation, were £478, or a deficiency of £1,471. It was reported that the business was originally taken over by Isle on May 9th, 1919, the purchase price being fixed at £600. He had no capital at the time, but obtained an overdraft at the bank for £200. In August, 1919, Jarrett entered into partnership with Isle and provided £100. At that time the business was carried on at High Street, Doncaster, at a rental of £30 per annum. The first year's trading showed a profit of £119, while for the year ended July 31st, 1921, the profit was £400. For the two years ended July, 1923, there was a profit of £682. In July, 1922, the premises in High Street were vacated, and they took the present premises at a rental of £300 per annum, in addition to rates. Certain parts of the premises had been sub-let, which reduced the net rental. The drawings of the debtors for the four years were as follows: Isle £1,142, and Jarrett £1,086. No trading figures had been prepared since July, 1923. The turnover for the period 1920 to July, 1923, amounted to roughly £14,000. An offer was submitted of 5s. in the £, payable as to 2s. 6d. in cash and 2s. 6d. in two months, the last instalment to be guaranteed. After discussing the matter it was resolved that the debtors should execute a deed of assignment to Mr. G. G. Oates, of Messrs. J. F. Clark & Co., I.A., Doncaster, as trustee, who was empowered to sell the assets for a sum sufficient to pay a composition of 5s. in the £.

Dissolutions of Partnership.—Neath Electrical Co., Neath.—Mr. E. L. Jones, Mr. J. T. E. Jones, and Mr. G. H. Rutter have dissolved partnership. Mr. G. H. Rutter and Mr. J. T. E. Jones will attend to debts and continue the business.

Electrical, Radio & Mechanical Engineering Co. (formerly Fairey & Goodenough), electrical, radio and mechanical engineers, Castleford, York.—Mr. C. Fairey, Mr. H. Goodenough and Mr. C. T. Waterhouse have dissolved partnership. Debts will be attended to by Messrs. Fairey and Goodenough.

Burke & Co., electricians, 61, Railway Street, Nelson.—Mr. J. Burke and Mr. F. N. Lyons have dissolved partnership. Mr. Lyons will attend to debts and continue the business.

Trade Announcements.—Messrs. L. G. Hawkins & Co., Ltd., have removed their Glasgow office to 57, Douglas Street, St. Vincent Street.

Messrs. Taylors Radio Electric, Ltd., of Cardiff, have opened a branch at 18, Drake Street, Plymouth.

Mr. E. H. Berry (Berry Engineering Co.), electrical and mechanical engineer, 13a, Canton Road, Shanghai (P.O. Box 584), has entered into partnership with two Chinese, one experienced in wiring systems, and the other in plant erection, armature and other repair work. He asks that British manufacturers should send catalogues (and samples if possible) to the above address as British material is thought very

highly of by Chinese mechanics. Good wiring work is a necessity owing to the extreme humidity in the hot season.

MESSRS. HAWKINS BROS., electrical and wireless engineers, of Kidderminster, have removed their business from 22, Oxford Street, to 101, Station Hill.

THE ARMATURE WINDING CO., LTD., 44a, Bolton Street, Bury, informs us that it has completed arrangements with Mr. B. Kay for the manufacture of the electrical wash boiler described in our "New Devices" of February 29th.

MESSRS. WALLACE (GLASGOW), LTD., have opened an office and showrooms at 6, White Street, Moorgate, E.C., with Mr. Tonkin in charge.

THE DOME ELECTRIC CO. is opening new premises and showrooms at 150, Stretford Road, Manchester, under the management of Mr. R. F. Petchler.

MR. P. G. RUDD has left the Ebonestos Manufacturing Co. and joined the Solidite Manufacturing Co., Ltd., as sales manager.

The registered office of the STANDARD CARBON BRUSH HOLDER CO., LTD., is now 12, Norfolk Street, Strand, W.C.2, and Messrs. Gillespie & Beales of that address have been appointed the company's sales agents. Mr. W. W. Browne has been appointed secretary.

Catalogues and Lists.—THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15. An illustrated show-card advertising accumulator batteries for radio purposes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A brochure, illustrated in colours, describing the lighting of the "New Tivoli," Strand, W.C.2.

BRITISH INSULATED & HELSBY CABLES, LTD., Prescot, Lancs. —Publication No. P. 187, describing the "Prescot" ceiling fan. Illustrated.

MR. H. C. SLINGSBY, 89, Kingsway, W.C.2. An illustrated list (No. 238) of steel-back ladders of several types.

MR. GEORGE ELLISON, Perry Barr, Birmingham.—List No. 5, illustrating and describing the "Ellison" plug and socket for trailing cables. Priced.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Leaflet 84, describing and illustrating "Tangent" terminals and their application to "Cogent" dry cells.

MATERIAL ELECTRIQUE ALEX LEFEBVRE, 9, Rue Arsène Houssaye, Paris (VIIIe).—List of plant for sale (No. 62), containing particulars of generating plant, steam plant, oil and gas engines, motors, transformers, &c.

ELECTRIC CONTROL, LTD., 177, Reid Street, Bridgeton, Glasgow.—A well-produced catalogue illustrating and describing the company's automatic pump control equipment.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—An illustrated brochure dealing with electromagnetic furnaces for the automatic hardening of steel.

BRITTAIN'S ELECTRIC MOTOR CO., 110, Cannon Street, E.C.4. —An illustrated and priced catalogue of a.c. motors and starters.

MESSRS. EWART & SON, LTD., 346-350, Euston Road, N.W.1. —An illustrated and priced catalogue of hot-water geysers of many patterns. Also leaflets dealing with a gas-heated copper and chimney cowls.

STANDARD VARNISH WORKS (OF GREAT BRITAIN), LTD., 34 and 35, Norfolk Street, Strand, W.C.2.—A comprehensive catalogue of insulating compounds, varnishes, enamel, &c., containing a number of useful tables of data relating to steam pressures, boiling temperatures, charring temperatures of insulating fabrics, &c.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4. Catalogue No. 67 containing illustrations, diagrams, and prices of shades, reflectors, bowls, and other lighting fittings.

ELECTRICAL PRODUCTIONS, Excelsior Works, Ellis Street, Birmingham.—A pamphlet describing the "Ventex" fuse system together with a detailed price list.

MESSRS. P. L. DWYER & CO., 30, Grosvenor Place, S.W.1.—April price list of electric cables, wires, conduits, and accessories.

BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A mailing card bearing illustrations of the company's "Radiola" receiving sets, loud speakers, valves, headphones, &c.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C.2.—A descriptive price list of second-hand X-ray and electro-medical apparatus for sale.

Electric Daylight at the Zoo.—For the purpose of obtaining daylight effects in the new Aquariums under the Mappin Terraces at the Zoological Gardens, Siemens daylight electric lamps have been installed with, we understand, very successful results. Each of the 95 show-tanks forms a beautiful picture due to the effective lighting, and the varied and picturesque backgrounds modelled by Miss Joan Proctor, F.Z.S. The tanks on the inner side of the gallery are illuminated with Siemens gasfilled daylight lamps, the glass bulbs of which are selectively tinted so that the light closely approximates actual daylight, and is effective on plants and fish alike.

Calendar.—From April, 1924, to March, 1925—barring accidents or change of taste—our office atmosphere will be sweetened by the presence of a calendar just received from the Metropolitan-Vickers Electrical Co., Ltd., of Manchester.

Book Notices.—An interesting example of modern publicity matter has come to hand from Messrs. S. H. Heywood & Co., Ltd., 5 and 7, Short Street, Tib Street, Manchester. This is an excellently-produced booklet dealing with country-house lighting. Commencing with the beauty and convenience of electric lighting in various applications—perhaps a trifle high-flown in parts—the matter leads gently up to the real motive of the booklet, the lighting plant. The illustrations are very good, that showing "Blackden Manor" at night being particularly so.

"Wireless Sets for Home Constructors," by E. Redpath. Pp. 129 + figs. 127. London: Radio Press. Price 2s. 6d.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII, No. 327, March, 1924. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The March issue contains the following papers:—Electrification of the French Midi Railway, by M. A. Bachellery; Phonofilms or Talking Pictures, by Mr. C. F. Elwell; The Characteristics of a D.C. Series Machine self-excited by Rectified Current for purposes of Regenerative Control, by Mr. R. D. Archibald; and Experiments on the Screening of Radio Receiving Apparatus, by Mr. R. H. Barfield.

Sir Isaac Pitman & Sons, Ltd., have issued their Spring List of new works covering a wide variety of subjects, including engineering, physics, mathematics, &c. An interesting feature of the catalogue is a list of the "Technical Primer" series.

"Electrical Measuring Instruments: Their design, construction and application"—Part I, "Commercial and Indicating Instruments," by C. V. Drysdale and A. C. Jolley. Pp. 440; figs. 377. London: Ernest Benn, Ltd. Price 55s. net.

"Science Abstracts" (A. and B.). Vol. XXVII, Part 3. No. 315. March 25th, 1924. London: E. & F. N. Spon, Ltd. Price 3s. each, net.

"The *Journal* of the Junior Institution of Engineers." April, 1924. London: The Institution. Price 2s.—Three papers are reprinted in this issue, *viz.*, "Electric Power Supply," by S. L. Pearce, C.B.E.; "Some Suggestions for Road Transport Development," by D. S. Capper, M.A.; and "Some Physiological Aspects of Heating and Ventilation," by Kenneth Gray, F.S.I. In addition there are notes on "lecturettes" and visits, proceedings of local sections, &c.

"Kempe's Engineer's Year Book for 1924." 31st edition. Pp. 2,905. London: Crosby Lockwood & Son. Price 30s. net.

City Electricity Charges.—The London Chamber of Commerce, in a circular letter which it has sent to members, deals with the question of the prices of electricity in the City of London. It is stated that a committee of the Chamber formed to investigate the matter recommends that an application for a reduction be made to the Electricity Commissioners. As this would involve an inquiry at which the Chamber would have to be legally represented, and as the corporate funds of the Chamber could not be used for this purpose, an appeal is made for contributions to a special guarantee fund by consumers of electricity.

The Increase in the Port of London Charges.—A representative conference of London Trading and Mercantile Associations and Exchanges, convened by the Transportation Committee of the London Chamber of Commerce, met last week to consider the increase in dock and warehouse charges of which notice has been given by the Port of London Authority. The general feeling of the meeting was that while some advances in rates were no doubt necessary, the proposed increases were too high, and in some instances would drive goods away from the Port of London. It was resolved to make strong representations to the Port of London Authority on the subject, and, failing agreement, to make an appeal under the Act to the Board of Trade, to hold an inquiry before the rates become operative.

French Companies.—Force et Lumière Electrique de l'Est is the style of a new company with a capital of 1,500,000 fr., formed by four other companies for operations in the eastern province of France.

With a capital of 500,000 fr. there has been embodied at Lyons (23, Rue Cavenne) the Etablissements Maljournal et Loustau, for manufacturing and trading in all kinds of electrical material.

The Compagnie Générale d'Exploitations Industrielles has changed its name to Compagnie des Magnétos Bosch, with offices at 17, Rue Théophile Gautier, Paris.

L'Energie Electrique de la Basse Ariège is the style of a company formed at Paris (12, Rue St. Florentin), with the object of working a concession for a water generating station at Pebernat (Ariège). Its capital is 500,000 fr.

With the object of constructing electric furnaces, and with a capital of 600,000 fr., which can be raised to 1,000,000 by simple decision of its board, the Compagnie Française des Fours Electriques has been formed, with offices at 102, Rue due Faubourg, Poissonnière, Paris.

An Important Hydro-Electric Contract.—An important contract has been secured by the British Mannesmann Tube Co., Ltd., for the supply of steel pipes, &c., in connection with the Tata Power Co.'s Nila-Mula or Bhira scheme. This is the third and greatest of the Tata enterprises for conserving and harnessing the storm water of the Western Ghats. The current generated is conveyed, by overhead transmission at a pressure of 110,000 volts, to Bombay, some 80 miles distant, where it is transformed down for the use of the mills, factories, tramways, railways, and other undertakings. The order for pipes is noteworthy as being the biggest for

a hydro-electric scheme that has ever been placed in Great Britain, if not in the world, and, following upon the important contract for 27 miles (20,000 tons) of 54 in. lapwelded steel pipes for the Thirlmere (Manchester Corporation) water scheme, now approaching completion, provides continuous employment for the company's plant at Newport (Mon.).

Prompt Fire Alarms.—Associated Fire Alarms, Ltd., has recently received two letters from firms at whose premises the "Pearson" fire alarm system had been installed. The first one refers to a small fire which was immediately detected by the alarm and enabled serious consequences to be avoided. The other states that although people were working upon other floors of the building, the presence of a fire was not noticed until attention was drawn to it by the alarm; in this case also the damage was negligible.

For Sale.—Beckenham Urban District Council Electricity Department invites offers for one 60-kW generating set, &c. Swansea Corporation Electricity Department has for disposal two 600-kW generating sets with surface condensers, pumps, &c. By instructions from Messrs. Douglas Hollis (Howden), Ltd., Messrs. R. & W. Mack will offer by auction on April 8th and following days, at Howden Airship Station, the plant, machinery, buildings, airship engines, &c. The receivers for the debenture holders of Messrs. Scholey & Co., Ltd., manufacturers of suction cleaners, electric motors, &c., Victory Works, Croydon, invite tenders for the purchase of the goodwill, patents, machinery, &c. Preston Corporation Electricity Department has several motor generators for disposal. (See our advertisement pages to-day.)

Prices Advance.—Messrs. Fuller's United Electric Works, Ltd., announce that owing to the increase in the cost of lead, all battery and lead-covered cable prices have been increased as from April 1st.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given:—

Flexarm. No. 443,957. Class 13.—Lamps. Red Dragon, Ltd., 39, Great Portland Street, London, W.1. March 26th, 1924.

Sure-A-Lite. No. 428,489. Class 8.—Electric batteries. Naamlooze Vennootschap Elementen Fabriek "Utrecht," 31, Gruttersdijk, Utrecht, Holland. (F. J. Smith, 94, Hurst Street, Birmingham.) March 26th, 1924.

Sturdy (lettering and design). No. 444,889. Class 8.—Apparatus for use in wireless telegraphy and telephony. John R. T. Falshawe and Basil H. Hardy, trading in co-partnership, 77, Broadway, Bexley Heath, Kent. March 26th, 1924.

Sonola. No. 445,272. Class 8.—Wireless telephonic receiving apparatus. Ward & Goldstone, Ltd., Manchester. March 26th, 1924.

Britezite (lettering and design). No. 445,042. Class 8.—Crystal detectors for use in wireless telegraphy and telephony. The British Central Electrical Co., Ltd., London, E.C.1. March 26th, 1924.

Radiolite (lettering and design). No. 440,004. Class 1.—A chemical product for charging electric batteries. Radiolite Battery Co., 555, University Avenue, St. Paul, Minn., U.S.A. (F. W. Golby, 3, John Street, Bedford Row, London, W.C.1.) March 26th, 1924.

Shelloid. No. 440,693. Class 50.—Electric switch covers, switch plates and insulators, all composed of synthetic material. J. A. Crabtree & Co., Ltd., Walsall. March 26th, 1924.

An L.C.C. Electric Meter-Testing Station.—Included in a new Bill which the L.C.C. is submitting to Parliament is the provision of an electric meter-testing plant.

Local Exhibition.—Aberdeen.—The Health and Home Exhibition was notable for the large variety of electrical apparatus displayed. Heating, cooking, lighting, and labour-saving devices were shown by, among others, Messrs. Andrew McRobb, Quickways, Ltd., Charles Brand, and Sellar & Co.

Electrical Industry in Guatemala.—We are informed that a "confidential" report on the general condition of the electrical industry in the Republic of Guatemala with notes on the principal electric light and power companies there has been received in the Department of Overseas Trade from the Acting British Vice-Consul at Guatemala City. This report has been issued direct by the Department to those firms whose names are entered on its Special Register for the receipt of such information—a system we have never liked because a Government Department should act in the interests of all manufacturers and not limit its operations to a few who choose to register. In the present case we are informed that other United Kingdom firms desirous of receiving the report, together with particulars of the Special Register service and form of application for registration, should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting the reference 9,000/F.L./C.C.2.

The Swedish Wireless Market.—The Commercial Secretary at Stockholm (Mr. H. Kershaw, O.B.E.) has sent a report to the Department of Overseas Trade regarding the popularity of "listening-in" in Sweden and the present demand for wireless receiving apparatus.

The Tramway Strike.—Acting upon the interim report of the Court of Inquiry into the tramway dispute, to say nothing of the recommendations of previous Royal Commissions, &c., the Minister of Transport, on March 25th, introduced a Bill for the regulation of London traffic. It is admittedly a temporary measure, and it aims at setting up an Advisory Committee to assist the Minister of Transport in dealing with matters concerning the transport systems of London. The Committee will consist of a chairman appointed by the Minister, twelve "ordinary" members, and six additional members. The appointment of the ordinary members will be in the hands of the Home Secretary (one), the L.C.C. (two), the City Corporation (one), the Metropolitan Borough Councils (two), the County Councils, other than the L.C.C. (two), the county boroughs within the London traffic area (one), the Home Secretary, for the Metropolitan Police (one), the City Corporation, for the City Police (one), and the Ministry of Transport (one, if the chairman is not an official of that Ministry). Two of the additional members will represent the transport workers, and four will represent the users of road vehicles and the providers of the means of transport. The Committee will consider the co-ordination of systems, the revision of previous legislation, improvements and developments, road maintenance works, &c.

The Bill provides, *inter alia*, for the stricter regulation of motor omnibuses, for action against the unwarranted holding up of traffic by street works, the prohibition or restriction of omnibuses upon routes in which public inconvenience may be caused by them, &c. The expenses of the Committee are to be defrayed from the Road Fund.

At Tuesday's meeting of the London County Council a resolution was to be put forward by Mr. H. A. Baker, protesting against the Bill, and expressing the opinion that an interim authority composed of representatives of local authorities in Greater London, endowed with adequate powers, should be appointed to deal with the London traffic problem.

The threatened strike of the employés of the Underground railway system, in support of the tramwaymen, did not take place; it was deferred on account of an offer made by the employers to the tramway employés. Briefly, the terms of the offer were as follows:—An increase of 6s. in the basic wage of the uniformed staff (motormen, conductors, inspectors, &c.); an increase of 4s. in the bonus of other grades; no reduction in the bonus until the cost-of-living index figure has fallen 8 points below 75 per cent. above the pre-war level; and the appointment of a committee to consider the questions of night work and other conditions. The men balloted upon the acceptance or refusal of this offer on Monday last, and the result was a majority of two to one in favour of acceptance, the figures being:—For, 9,428; against, 4,377. In consequence of this result the men resumed work on Tuesday morning, the normal services being quickly restored.

British Empire Exhibition Notes.—The Salford Town Council is recommended to authorise the Electricity Committee to attend the general meeting of the Incorporated Municipal Electrical Association, to be held at the British Empire Exhibition, Wembley, on September 17th, 18th and 19th, 1924, in order to enable it to keep in touch with the latest developments in the electrical world.

Builders' Strike.—On Monday last the building trade employés at the Exhibition, numbering, it is reported, about 10,000, ceased work. The reason is given as the delay in granting an increase of 2d. per hour for which the men asked some time ago; the demand is a national one. The officials of the men's trade union stated that the strike was not ordered by the union.

The Pluto Stoker.—Owing to a misprint on p. 475 of our issue of March 21st, it was stated that the stoker could be made in all sizes between 11 and 12 ft.; this should read "11 and 21 ft." The address of the Pluto Stoker company is 2, Upper Westbourne Terrace, London, W.2.

New Showrooms.—Chester.—The City Council has approved a recommendation of the Electricity Committee that premises at 22 and 24, Northgate be purchased at a cost of £10,000 for the purpose of providing showrooms and offices for the electricity department, and that application be made to the Electricity Commissioners for sanction to the borrowing of that amount.

Lighting and Power Notes.

Australia.—Ballarat (N.S.W.).—It is anticipated that the municipal electricity scheme will be inaugurated before the end of the present year. The following charges will be made:—Lighting, 7d. per kWh; power, 3½d. per kWh.

Burgess Hill.—Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation, a Special Order made by them authorising the Burgess Hill & District Electric Supply Co., Ltd., to supply electricity in the urban district of Burgess Hill, and certain parishes in the rural districts of Chailey and Cuckfield.

Bury.—LOANS.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to borrow £5,000 for alterations and extensions to Rochdale Road sub-station. The Committee has received sanction to borrow £2,170 for an underground cable to Heywood borough boundary.

Continental.—ITALY.—Work on the scheme for harnessing the Silani lakes, for which the Società per le Forze Idrauliche della Sila has secured a concession, is now in hand, and it is expected that 100,000 h.p. will be available by the end of 1928. Five power stations are to be erected, the largest of which, that of Timpa Grande on the river Neto, will have a capacity of 140,000 h.p. The electrical energy will be distributed for use in the southern provinces.

AUSTRIA.—The Town Council of Bitolj has decided to erect a power station to provide an electricity supply for the town.

SWEDEN.—The Government has submitted to the Riksdag a proposal for the construction of Government-owned hydro-electric works at Norrforsen on the Ume river at an estimated cost of kr. 6,050,000. An appropriation of kr. 1,500,000 is requested for the purpose of starting work.—*Reuter's Trade Service* (Stockholm).

Darlington.—ELECTRICITY EXTENSIONS.—The Electricity Committee has recommended to the Town Council that, providing the demand for an electricity supply justifies the expenditure, application be made to the Electricity Commissioners for sanction to a loan for mains to supply electricity to villages outside the borough.

Dover.—ELECTRICITY SUPPLY.—Owing to difficulties which have arisen concerning the linking-up of the Dover and Folkestone electricity works, which was ordered by the Electricity Commissioners, the Town Council has decided to appeal to the Commissioners to allow the installation of another new turbine at the Corporation works instead of linking up. The borough electrical engineer has informed the Council that the cost of linking-up with Folkestone would be about £20,000, and the new turbine would cost considerably less.

Dunoon.—ELECTRICITY SUPPLY.—A provisional agreement has been arranged between representatives of the Town Council and the Greenock Corporation with regard to a supply of electricity to Dunoon. It is proposed that a bulk supply should be given by Greenock Corporation, the Dunoon Council to guarantee a payment of 10 per cent. per annum on the outlay incurred by the Corporation, plus 1d. per kWh for electricity supplied, the period of supply to be 21 years, and the Dunoon Council to apply for an Order authorising it to distribute electricity in its area. The agreement has been approved by the Greenock Corporation, and is to be brought before Dunoon Council for decision.

Exeter.—ELECTRICITY EXTENSIONS.—At a meeting of the City Council on March 25th, Mr. A. Brock, chairman of the Electricity Committee, recommended the Council to approve schemes for the extension and standardisation of the electricity works at a total cost estimated at £75,000. It is proposed to install an additional 1,500-kW turbo-alternator suitable for working at a frequency of either 60 cycles or 50 cycles, as required. This set, which is estimated to cost £15,000, is to be used for the time being on the 60-cycle system and afterwards adapted to 50 cycles when there is a change-over to that frequency. The growth of the undertaking necessitates further plant being provided, and it is hoped to install a 3,000-kW turbo-alternator and have it ready for use in two years' time, when the new system will be fully adopted. This second scheme will cost about £60,000, and will include an extension of buildings and new boilers, steel chimneys, economisers, and coal bunkers. Towards the cost an offer of 50 per cent. of the interest on the loan for 15 years has been received from the Unemployment Grants Committee. The two schemes were sanctioned by the Council.

Glasgow.—ELECTRICITY SUPPLY FOR TRAMWAYS.—Sir Philip Dawson has been appointed by the Corporation to advise on the question as to whether additional plant should be installed at Pinkston tramway power station or current be obtained from the Electricity Department direct.

"ALL-ELECTRIC" HOUSES.—The first "all-electric" housing scheme to be completed by the Corporation at Cathcart Road was formally opened on March 27th by the Lord Provost. The scheme comprises 62 houses, and provision is made in all the houses for cooking, heating, and lighting by electricity.

Heckmondwike (Yorks.).—ELECTRICITY IN BULK.—At a recent meeting of the Urban District Council it was reported that new converting plant would be installed early in April, when the existing plant would be closed down and a supply of electricity in bulk would be obtained from the Yorkshire Electric Power Co.

Houghton-le-Spring.—ELECTRICITY CHARGES.—The Ratepayers' Association has decided to make representations to the Houghton-le-Spring & District Electric Lighting Co., Ltd., to reduce the charge for electricity, which, it is stated, is much higher than in other areas served by the company. The present charge for lighting is 7d. per kWh.

Hoylake and West Kirby.—LOAN.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £16,000 for further extensions to plant. It was stated at a recent meeting of the Council that tentative permission had been obtained from the Electricity Commissioners whereby in the future the Council will be able to duplicate the plant.

Inverness.—PROPOSED PURCHASE OF UNDERTAKING.—The Town Council has received the consent of the Aberdeen Corporation to acquire the services of its electrical engineer, Mr. J. Alex. Bell, to advise the Council in connection with the proposal to purchase the electricity undertaking of the North of Scotland Electric & Power Co., Ltd., in Inverness. The estimated capital cost was £60,000 on December 31st last, but since that date the company has put in hand new work involving an expenditure of £20,000.

Kingston-on-Thames.—LOANS.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £28,369 for electricity purposes, and has applied for sanction to a further loan of £38,500 for the installation of a new 3,000-kW set.

Lancaster.—INAUGURATION OF POWER STATION.—The Electricity Committee is arranging to formally open the Caton Road power station on June 26th.

Leicester.—INQUIRY.—An application by the Corporation for authority to supply electricity to a number of villages near the city was the subject of an inquiry at the Town Hall, Leicester, on Wednesday, by Colonel T. C. Ekin, chief engineering inspector to the Electricity Commission. Mr. H. A. Pritchard, town clerk, acted for the Corporation; and Mr. Alexander McMorran, K.C., Mr. W. McGill, and Mr. F. Thursfield appeared for the Leicestershire & Warwickshire Electric Power Co., who claimed certain rights with respect to the villages of Anstey, Wanlip, Syston, and Barkby. Colonel Ekin stated that the Corporation had applied for permission to include in its area the Thurmaston urban district area, nine parishes under the Barrow-on-Soar R.D.C., and six parishes under the Blaby R.D.C. The town clerk explained that all the authorities concerned had given their consent to the scheme, but the company urged that it could more efficiently and economically supply certain places. Mr. T. R. Smith, city electrical engineer, stated that the electricity department was prepared to lay mains to Syston and Anstey at once. Mr. McMorran said the company had been preparing to develop the area for some time. A sub-station was nearing completion at Coalville, and electricity would be supplied from that station. It was proposed to link up Coalville, Hinckley, and Warwick. The inquiry closed, and Col. Ekin will report in due course.

Littleborough.—LOAN.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £3,400 for laying a cable for the lighting of the main road from Whittle Street to the boundary at Sleanor Bottoms.

Llandrindod Wells.—NEW PLANT.—The Urban District Council is to install an oil engine at the electricity works at a cost of £1,323.

London.—HACKNEY.—The borough electrical engineer has submitted a report to the Electricity Committee on the proposal to increase the capacity of the transformers used in connection with the link with the North Metropolitan Electric Power Supply Co., and the Committee has recommended that the existing bank of three 500-kW transformers be replaced by a new bank of three 1,000-kW transformers, and that the necessary structural and electrical alterations be carried out for the installation of the new plant at an estimated cost of £2,500, of which £1,250 will be paid by the company. It is also recommended that certain underground feeding boxes be replaced by above-ground feeder pillars before next winter.

Millom (Cumberland).—ELECTRICITY SUPPLY.—The Urban District Council has approached the Millom & Askam Hematite Iron Co., Ltd., with a view to obtaining a supply of electricity for the district.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LITTLEBOROUGH.—Power to domestic consumers who take a lighting supply: For the first 300 kWh per quarter, 1½d. per kWh; above this amount 1¼d. per kWh.

BROMLEY (KENT).—*Bromley Electric Light & Power Co., Ltd.*—Lighting: From 9d. to 8d. per kWh with a minimum charge of 10s. for the winter quarters, and 6s. 8d. for the summer quarters.

LONDON.—*St. James's & Pall Mall Electric Light Co., Ltd.*—Lighting: 5½d. to 4d. per kWh, according to quantity consumed. Power and heating: 1½d. per kWh.

ALDERSHOT.—Lighting: From 9d. to 8d. per kWh; where power consumption exceeds 5,000 kWh per quarter, a special rate of 6d. per kWh for lighting used for industrial purposes. Power: From 4½d. per kWh maximum and 2½d. minimum to 4d., and 2½d. per kWh. Heating and cooking: Where the demand is equal to 600 watts and upwards and where current is used for lighting purposes, 2d. per kWh.

LLANDRINDOD WELLS.—Heating and cooking: 4d. per kWh.

WESTON-SUPER-MARE.—*Weston-super-Mare & District Electric Supply Co.*—Power: 4d. per kWh for the first 1,000 kWh per quarter, 3½d. per kWh for the next 1,000 kWh, and 2½d. per kWh beyond, with a discount of ¼d. per kWh for prompt payment of accounts.

Kingston-on-Thames.—Lighting: Varying from 7½d. to 3½d., according to quantity consumed. Basement lighting: Varying from 4d. to 3d.

Leicester.—Cooking, heating, &c.: From 6s. 9d. per lamp-holder per annum, plus 1d. per kWh, to 5s. 9d. per lamp-holder, plus 1d. per kWh. Cooking, flat rate: From 1½d. to 1d. per kWh. Rental for cookers: From 12s. to 3s. per quarter in the case of large cookers; from 10s. to 2s. 6d. for small cookers. Power: From 60 to 50 per cent. above the pre-war rate.

Redruth (Cornwall).—Electricity Charges.—At a recent meeting of the Urban District Council, a communication was received from the Urban Electric Supply Co. stating that while the company was prepared to extend for a further six weeks the present scale of charges for street lighting, the increase proposed would be put in force at the expiration of that period. The new charges are stated to be over 33⅓ per cent. higher than the old, involving an addition of £300 a year to the cost of lighting the town, and an additional rate of 1d. will be levied to meet them.

Saffron Walden.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £7,000 for carrying out an electric lighting scheme.

Seaford.—Electricity Supply.—Mr. W. C. C. Hawtayne, M.I.E.E., has submitted to the Urban District Council particulars of two alternative schemes of electric lighting. One provides for current in bulk from Eastbourne, at a cost of about £34,000, and the other for the erection of a power station at Seaford, at an estimated cost of between £37,000 and £38,000.

Skipton.—Proposed Extension of Supply.—The Urban District Council has appointed a sub-committee to meet a sub-committee from the Silsden Urban District Council in connection with a proposal to supply electricity to the Silsden district.

South Africa.—Witbank Power Station.—According to the *Times Trade and Engineering Supplement*, work on the new Witbank power station is to proceed at once; provisional contracts for the plant have already been placed, and it is expected that electricity will be generated before the end of next year. It will be transmitted to the Rand over a line 100 miles in length at a pressure of 130,000 V. The new station will be run by the Victoria Falls and Transvaal Power Co., on behalf of the Electricity Commission. The cost is estimated at about £1,250,000.

Swansea.—Electricity Extensions.—The Town Council is to extend the existing overhead transmission line connecting Amman Valley to Manselton *via* Pontardawe, Clydach, and Moriston, at a cost of £35,000, in order to provide a bulk supply for Pontardawe Urban District Council and the Blaencaegurwen, Gilwern, Brynamman, New Brook, and Raven Collieries.

Truro.—Electricity Agreement.—The City Council has affixed its seal to an agreement with the Cornwall Electric Power Co. for a supply of electricity in bulk to the city.

A meeting of ratepayers on March 22nd demanded the holding of an inquiry before the scheme was proceeded with.

Tramway and Railway Notes.

Birmingham.—New Route.—Considerable progress has been made in connection with the construction of the new tramway between Longbridge and Rednel, and it is anticipated that the work will be completed before Easter, and that it will be possible to run a through service from Birmingham to the Lickeys on the Bank Holiday. The present fare to Longbridge is 4d. and the return workman's fare 6d. The through fare to Rednel terminus will be 5d. and the workman's return fare 7d.—*Birmingham Daily Mail.*

Chile.—Proposed New Electric Railway.—The proposed railway from Valparaiso to Santiago, *via* Casa Blanca, is under discussion. Experts who have for some time been considering the feasibility of this new line report in favour of the construction of an electric railway of the same gauge as the State line connecting Valparaiso and Santiago. The new line is to pass through Casa Blanca, and will possess two branches. One of these will connect with Mellpilla, thus shortening the distance between Valparaiso and the newly-developed port of San Antonio; the second branch will run to Talagante, linking with the central line to Santiago at Paine. Recommendations are made that this line should be constructed on an electrical system similar to that nearing completion on the present route from Santiago to Valparaiso. The President is understood to support the proposal to begin work as soon as possible. It is hoped that if the Legislature approves of the scheme in the next session, negotiations will be entered into with foreign industrialists for the commencement of work on this route.—*Reuter's Trade Service* (Valparaiso).

Continental.—Austria.—The Town Council of Vienna has placed orders for 100 tramcars, with motors, and 100 trailer cars for the recently-electrified city tramways.

Glasgow.—Subway Railway.—At a recent meeting of the Tramways Committee, a sub-committee submitted reports prepared by Mr. W. C. Easton, consulting engineer, and the engineers and general manager of the Tramways Department. According to the *Glasgow Evening News*, Mr. Easton is of opinion that the existing tunnels could be put into condition fit to carry a first-class "tube" service, electrically-operated with the standard gauge of 4 ft. 8½ in., but with a smaller car than that in use in London. All stations would require to be improved, and the Kelvinbridge, St. George's Cross, and Buchanan Street stations should be provided with mechanical means of transporting passengers from the platform to the street. The reports of the general manager and the engineers indicated that the question which gave most concern was the provision of accommodation for the inspection and repair of the cars and their equipment. Mr. Dalrymple stated that after electrification, it would be necessary to attain a speed of 30 miles an hour, and the tunnels would require to be made suitable for that speed. Further Parliamentary sanction would be required for such an extensive reconstruction, which meant that it could not be completed until about the middle of 1926. The sub-committee decided to recommend that the process of cementation in the tunnels should be continued wherever necessary, and that it be remitted to the manager to obtain an offer from the Francois Cementation Co., Ltd., for carrying out the work. Further consideration of the reports was deferred till a future meeting.

London.—Hampstead Tube Breakdown.—A breakdown occurred on March 23rd at 7.40 p.m. on the Hampstead Tube at Belsize Park station. The stoppage was due to a motor defect, and normal working was resumed at 11 p.m.

Manchester.—New Route.—With a view to providing work for the unemployed, the Corporation is to construct a tramway track in Victoria Avenue, Blackley, at a cost of £50,000.

West Ham.—Proposed Railless Cars.—The Tramways Committee has recommended that action be taken to apply for the necessary powers to run omnibuses or railless cars in the borough, and, with consent, in the areas of adjoining authorities; but primarily for powers to introduce a service between Silvertown and Canning Town stations.

Telegraph and Telephone Notes.

An Improved Cable.—"Permalloy" Type.—The nickel-iron alloy invented last year in the laboratories of the Western Electric Co., is to be used in the construction of the new cable to be laid by the Western Union Telegraph Co. from New York to the Azores. The order followed the success of tests made with 120 miles of experimental "permalloy" cable off Bermuda last summer. The new cable differs from the old form only in having a thin "permalloy" tape wrapped around the copper wire beneath the gutta-percha insulation. It is expected to have a traffic capacity four times that of existing cables of the same size. The invention of "permalloy loaded cable" has unusual significance, for it is the first radical change in cable construction in more than fifty years, and may mean the laying of direct cables of a length hitherto impossible on account of cost or limit of traffic capacity. The new metal is composed of about 80 per cent. pure nickel and 20 per cent. pure iron. It is the most easily magnetised and de-magnetised of all metals, which is of peculiar value in submarine cable work where large magnetic effects are desired from small currents.—*Science Service.*

China.—New Radio Station.—The three-cornered controversy between China, Japan, and the United States over radio-telegraph rights in China was enlivened on March 25th by the announcement that the Japanese Mitsui Co.'s station, 15 miles east of Peking, has been finally perfected and will shortly be prepared to offer direct communication between Peking and London, New York, Berlin, Copenhagen, and other world capitals with a faster and cheaper service than that of the cables. Representatives of the United States Federal Wireless Co. are said to be proceeding to Peking to take up the situation with the Chinese Government, which after granting exclusive privileges in China to Japan, declared that delays had abrogated the contract, and later granted privileges to the American company.—*Daily Mail.*

Germany.—Large Experimental Radio Station.—According to the *Manchester Guardian Commercial*, the high-power radio station being erected by Messrs. C. Lorenz on the Herzogstand, near the Walchen Lake power station, in Upper Bavaria, is first to be used for experiments on a large scale, in order eventually to be employed for long-distance radio telegraphy, mainly for communication with the Far East. The absence of any antenna mast is its main distinctive feature. Electrical energy will be derived from the near-by power station, under especially easy conditions and at relatively low rates. A Poulsen-Lorenz arc transmitter of about 2,000 kW, side by side with a Schmidt high-frequency transmitter of the same output, will be used, the high frequency being at will either produced direct in the transmitter or stepped up by frequency transformers. The plant will, it is thought, afford means of comparing the two types of generator in actual service. The mountain antenna comprises five wire cables extending fan-like from the Stein, a mountain about 940 metres high near the Kochel Lake, to the Herzogstand mountain, 1,732 metres high, a wire provided in the centre

connecting this system to the station building. It is expected to start experimental operation about the middle of the year.

Greece.—Telegraph Communication.—Negotiations between the Greek and Turkish Governments have finally resulted in an agreement to re-establish telegraphic communication between the two countries. Dispatches follow the line from Adrianople to Saloniki, from which they are distributed to their destination. Telegraphic communication between Greece and Smyrna, through Mytilene, is also to be resumed.—*Commerce Reports.*

Inter-American Communication.—Radio Conference.—Rules for the regulation of radio throughout the Western Hemisphere were to be formulated at the Inter-American Electrical Communications Conference which was to meet in Mexico City on March 27th. The United States was to be represented, and all Latin-American countries, and Canada, were expected to send delegates. The conference was proposed at the meeting of the Pan American Congress at Santiago, Chile, last year; and the place of meeting was decided at a meeting of Latin-American representatives at the Pan American Union in Washington. All forms of electrical communication were to be discussed, but radio was to be the principal topic, the general purpose of the conference being to bring up to date the regulations adopted at the London radio conference in 1912, and to amend them to fit conditions in the Western Hemisphere. An international conference for the drawing up of radio regulations for the entire world has been proposed to the Advisory Committee on Communications and Transit of the League of Nations with the request that the Council of the League take the necessary preliminary steps. The proposal was made by a committee of radio experts which recently met in Geneva. No official recognition of the proposal has yet been made by the United States.—*Science Service.*

United States.—Radio in Mine Rescue Work.—In the course of experiments designed to perfect methods for the establishment of radio communication between persons entombed in mine disasters and rescue workers on the surface, conducted by the Department of the Interior at the experimental coal mine of the Bureau of Mines, near Pittsburgh, Pa., signals have been transmitted obliquely through a distance of 800 ft. of rock by the use of the T.P.S., or ground conduction system, developed by the Army Signal Corps. Signals were also transmitted with little difficulty by using compressed air piping, car rails, and other similar conductors. The intervention of such poor conductors as water, coal, and mud, and the substitution of wooden for steel rails, did not interfere with the transmission of signals. The T.P.S. method of ground telegraphy requires no wire connection between the sending and receiving stations; it differs from radio-telegraphy in that the transfer of electrical energy from the transmitting to the receiving apparatus takes place mainly by conduction and, to a much less extent, induction through the ground, instead of through the air. The method cannot be used for speech transmission.—*Reuter's Trade Service* (Washington).

New Directive Radio Beacon.—A new directive radio beacon which will be of great use to navigators of the air or water has been perfected by the U.S. Bureau of Standards in co-operation with the Signal Corps and Air Service of the Army. It will make direction finders on shipboard less necessary. The beacon consists of two coil antennæ so placed as to cross each other at an angle of 135 deg. The transmitting set is automatically connected first to one and then to the other, one letter of the signal being sent over each. The intensity of the signal from an antenna of this type varies from a maximum in the plane of the coil to almost zero at right angles. A receiving set placed along the line bisecting the angle between the coils will, therefore, receive signals of equal intensity from both. A ship or aeroplane receiving the signals will be able, by first proceeding to the point where the two signals are of equal intensity, to steer directly for or away from the beacon without regard to conditions of visibility. The signals may be received by the most ordinary receiving set. It has already been tested successfully along the Potomac River and Chesapeake Bay by the Lighthouse Service, and may be used on the Mississippi River in lighthouses, but not on lightships, since they are continually shifting their directions with wind and tide.—*Science Service.*

Radio Notes.

Australia.—New Stations.—The Broadcasting Co. of Australia Proprietary, Ltd., has started operations in Melbourne. It has an authorised capital of £100,000, and will be conducted on the same lines as Farmer & Co.'s service in Sydney, which is owned and controlled entirely within New South Wales by that company, and will operate in various States other than New South Wales. The Melbourne aerials will be probably 300 ft. in height, and will operate on 5 kW. Farmer & Co.'s service in New South Wales is at present working on a ½ kW, as the full power (5 kW) system, now under construction, will not be completed for some time. It is understood that another company is in process of formation in South Australia, and in which Broadcasting of Australia Proprietary, Ltd., will be interested. In addition, the Melbourne and Sydney stations will have a working arrangement by which subscribers in either city may be linked up with both stations with a multi-wave receiver. Similar arrangements will probably be made between the capital cities of Victoria and South Australia. Smaller services, operating on a ½ kW, are also to be established in Sydney and Melbourne.—*Industrial Australian and Mining Standard.*

Austria.—Broadcasting Company.—The formation of a company called "Broadcasting A.G." is being undertaken by the Austrian Government. Applications for concessions from the German Telefunken Gesellschaft, the E. Schrack Radio Werke, and other companies had been pending, but it was decided not to grant a radio monopoly to any privately-owned concern. A majority of the shares of stock of the new company will be held by the Austrian State.—*Commerce Reports.*

Canada.—Radio on Trains.—The latest train on the Canadian National Railways to be equipped with radio receiving sets is the International, Ltd., running daily between Montreal and Chicago. In the observation car, in addition to the loud speaker, eight pairs of headphones are attached to the set. This style of equipment will be standardised throughout the system. The transcontinental trains of the Canadian National Railways are now equipped with radio receiving sets, and all the important passenger trains will be similarly equipped as early as possible. The Canadian National Railways, in addition to utilising independent broadcasting stations, have a powerful broadcasting station of their own in Ottawa.—*Reuter's Trade Service* (Montreal).

Educational Broadcasting.—New Schemes.—The London County Council Education Committee has decided to permit the reception in its schools of six experimental "wireless talks" during April and May.

In Australia the Minister of Education has launched a scheme to enable "out-back" students to hear by means of radio broadcasting lectures delivered in the universities.

It is also reported that in Germany a Berlin concern called "The Ullstein Service" is broadcasting a lesson in English twice a week. Special leaflets are being issued to enable pupils to perfect their knowledge.

France.—New Broadcasting Station.—The new Paris broadcasting station controlled by *Le Petit Parisien* generally radiates a concert between 10.30 p.m. and midnight on Thursdays and Fridays, on a wave-length of 340 m., the power used being about 300 watts.

Irish Free State.—Dail Committee's Report.—The Dail Committee on radio broadcasting issued its final report on March 28th, and all the evidence which had been given at the inquiry was published. The chief recommendations of the Committee are, says *The Times*, that broadcasting in the Free State shall be a purely Government affair and shall be controlled absolutely by the General Post Office. It recommends, further, that one transmission station should be established in the neighbourhood of Dublin, and estimates that the annual cost of this station, apart from the cost of programmes, &c., would be about £5,000. The Committee is of the opinion that there would be about 4,000 crystal sets in use in the Dublin district, and that the initial number of valve sets throughout the country would be about 1,000.

New Station.—Plymouth.—The Plymouth relay station was opened by the Mayor, Mr. Solomon Stephens, in the Guildhall, on March 28th. Programmes included items relayed by trunk-phone from London. The station call is 5PY, with a wave-length of 340 metres.

United States.—New Broadcasting Station.—According to the Press, it is hoped that a new American broadcasting station, established by the *Chicago Tribune*, which was to begin operations on March 29th, will be heard in England. The wave-length is 370 metres, and the call signal WGN.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—April 18th. Electricity Department. 90 tons (approx.) structural steelwork for the boiler-house extension. (See this issue.)

Australia.—Perth.—April 23rd. Postmaster-General's Department. Accumulators.*

The High Commissioner for Australia (Sir Joseph Cook) is inviting tenders for the erection of a new radio station at Wave Hill, in the northern territory of Australia. The station is to provide wireless telegraphic communication between Wave Hill and Darwin, a distance of 350 miles, and between Wave Hill and Wyndham, a distance of 300 miles. It is a condition of the tender that the transmitting apparatus shall be capable of change for use as a radiophone transmitter. Tenderers who do not wish to tender for the erection of the plant may quote for its delivery c.i.f. Australia, in which case it will be erected by the Government engineers.

Belgium.—April 15th. Municipal authorities of Tamines (Province of Namur). Supply of distribution cable.

May 6th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Telephone cable and accessories. Particulars (Cahier des Charges Special No. 775) for 6¼ fr.

April 15th. Municipal authorities of Ixelles, Brussels. Rotary transformers for sub-stations.

The Société Co-operative "Onze Molen," 15, Longue Rue Neuve, Antwerp. Installation at the bakery at Gheal-Vaart of a 200-h.p., 200-V dynamo and four electric motors of a total of 175 h.p., together with the necessary switchboards and accessories.

Cardiff.—April 24th. Electricity Department. One 5,000-kW turbo-alternator and condensing plant. (See this issue.)

Dublin.—April 30th. Electricity and Public Lighting Committee. Flame carbons. (See this issue.)

Edinburgh.—April 14th. Electricity Supply Department. Insulated cables, conduits, pavement box frames and covers, and house-service fuse boxes. (See this issue.)

Egypt.—Cairo.—May 31st. Egyptian Ministry of the Interior. Pumping plant, &c., for Mehalla el Kobra. Electric motors and accessories, pumps and accessories, cables, filters, including alum distributing apparatus, switchboards, tools, and plant.*

London.—Stepney.—May 1st. Electricity Supply Committee. Coal handling plant and ash handling plant for the Limehouse generating station. (See this issue.)

Manchester.—April 8th. Tramways Committee. Supply of creosoted red wood sleepers. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middlesbrough.—April 11th. Electricity Department. 12 months' supply of cables and a.c. meters. (See this issue.)

New Zealand.—Wellington.—July 29th. Public Works Department. Turbines and generators.*

July 1st. Pipe lines for the Lake Coleridge electric power scheme.*

Auckland.—June 23rd. Electric Power Board. One 5-ton electric travelling crane.*

Wairoa.—May 1st. Town Council. Centrifugal pumps and electric motors.*

Plymouth.—April 10th. Electricity Department. Travelling band condenser circulating water screen. (March 28th.)

Salford.—April 7th. Electricity Committee. Supply, laying, and jointing of approximately 2,850 yd. of 6,600-V cable. Particulars from borough electrical engineer.

South Africa.—Durban.—May 2nd. Water Engineer's Department. Shongweni Scheme, Vernon Hooper Dam. Large sluice valves, pipes, water turbine generating plant, &c.*

Stoke-on-Trent.—April 16th. Electricity Department. 12 months' supply of a.c. and d.c. meters and maximum demand indicators. (March 28th.)

Truro.—April 19th. City Council. Work connected with the proposed electricity undertaking. (March 21st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Electricity Committee. Recommended:—
Two water-tube boilers (£26,730).—Vickers-Spearing Boiler Co., Ltd. Seven tenders were received. The Committee points out that when offers were invited for similar boilers in 1920 the estimated cost was £41,870.

Australia.—The Australian Government has just placed an important order for two automatic telephone exchanges for Sydney, equipped for 12,000 subscribers, the value being nearly £300,000. The equipment will be manufactured in England by the Automatic Telephone Manufacturing Co., Ltd., of Liverpool.

Bath.—Electric Lighting Committee. Recommended:—
3,000-kW turbo-generator (£25,455).—Brush Electrical Engineering Co., Ltd.
Two 40,000-lb. capacity water-tube boilers, &c. (£12,477).—Clayton and Shuttleworth, Ltd.
Two pairs of mechanical stokers (£3,950).—E. Bennis & Co., Ltd.

Belgium.—Four Belgian concerns submitted tenders to the Belgian State Railway authorities in Brussels on March 19th for the supply of 30,000 metres of insulated bronze wire, the lowest offer being that of the Société de Cables Electriques en Caoutchouc, of Eupen. For the contract for 80,000 metres of insulated copper wire one British and three Belgian offers were received, the lowest being that of Callender's Cable and Construction Co., Ltd., London.

Boston.—The following are the contractors in connection with the construction of electricity works for the Electric Lighting Co.:—
Main contractors.—National Electric Construction Co., Ltd.
Sub-contracts.
Turbo-alternators and condensers.—Allen & Co., Ltd.
H.p. and l.p. switchgear.—New Switchgear Construction Co., Ltd.
Economisers.—E. Green & Sons, Ltd.
Steel work for power house, &c.—Edward Wood & Co.
Power house.—J. W. Pinder & Son.
Cable laying.—British Insulated & Helsby Cables, Ltd.
Electrical machinery.—Crompton & Sons.

Croydon.—The following tenders were received for a 50-ton electric crane for the borough Electricity Department:—

Higginbottom & Mannock. (Accepted.)	**£1,935**
Herbert Morris, Ltd.	2,075
S. H. Heywood	2,142
W. Wharton	2,175
Holt & Willetts	2,198
Marshall, Fleming	2,198
Isles, Ltd.	2,245
Alex. Jack	2,250
Chatteris Engineering Co.	2,291
Carrick & Son	2,306
Carrick & Ritchie	2,359
Broadbent & Son	2,494
Babcock & Wilcox	2,545
Oerlikon	2,550
Royce, Ltd.	2,600
Jas. Spencer	2,610
J. Smith	2,622
G. P. Banbury	2,729
J. M. Henderson	2,815
Stothert & Pitt	2,923
Butters	2,930
Willman & Smith	2,973
S. Butler	3,167

India.—Tata Power Co.'s hydro-electric scheme.
Supply of welded and riveted steel pipes, &c.—British Mannesmann Tube Co., Ltd.
The contract for pipes is stated to be the largest of the kind that has ever been placed in Great Britain.

Kettering. — Electricity Department. Feeder cables, feeder pillars and boxes:—

Union Cable Co., Ltd. accepted (provisionally)	**£1,508**
Pirelli-General Cable Works, Ltd.	1,534
British Insulated & Helsby Cables, Ltd.	1,535
Johnson & Phillips, Ltd.	1,535
Western Electric Co., Ltd.	1,544
W. T. Henley's Telegraph Works Co., Ltd.	1,548
Siemens Bros. & Co., Ltd.	1,559
W. T. Glover & Co., Ltd.	1,577
Callender's Cable & Construction Co., Ltd.	1,612

London.—Metropolitan Water Board. Accepted:—
Vacuum lamps for 12 months.—Siemens & English Electric Lamp Co., Ltd.

Islington.—Borough Council. Accepted:—
Electrical accessories, conduit, cable, tinned copper wire.—Edison Swan Electric Co., Ltd.

Newcastle-on-Tyne.—Transport and Electricity Committee. Accepted:—
25 double-deck tramcars (£60,000).—Brush Electrical Engineering Co., Ltd.

Salford.—Electricity Committee. Accepted:—
Coal and ash transporting plants for Agecroft power station (£14,884).—Mitchell Conveyor & Transporter Co., Ltd.
Service cables and accessories (£9,793).—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—
Electric lamps for 12 months.—British Thomson-Houston Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Siemens & English Electric Lamp Co., Ltd; General Electric Co., Ltd.
Stores and materials for 12 months:—
Coils, &c.—Manchester Armature Repair Co., Ltd.
Armature coils.—Barratt & Thornton.
Gears and axles.—Cammell, Laird & Co., Ltd.
Steel tires.—Hadfields, Ltd.
Pinions.—British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Brown, Bayley's Steel Works, Ltd.
Brake blocks.—National Rail & Tramway Appliances Co., Ltd.
Axles.—J. Baker & Co. (Rotherham, 1920), Ltd.

Forthcoming Events.

Royal Institution of Great Britain.—Friday, April 4th. At 21, Albemarle Street, W. At 9 p.m. Lecture on "The Nucleus of the Atom," by Sir E. Rutherford, F.R.S.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 5th. At the Park Hotel, Cardiff. Annual meeting and annual dinner.

Electrical Trades Benevolent Institution.—Monday, April 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 2.30 p.m. Annual general meeting.

Institute of Transport.—Monday, April 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Organisation of Traffic and Locomotive Departments in Relation to Running," by Mr. H. A. Watson.

Institution of Civil Engineers.—Tuesday, April 8th. At the Institution, Great George Street, S.W. At 6 p.m. Joint meeting with the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the B.E.A.M.A., the B.E.A., &c. Discussion on "Standards of Comparison in Connection with the Thermal Efficiency of Internal-Combustion Engines," to be opened by Mr. G. J. Wells.

Institute of Marine Engineers.—Tuesday, April 8th. At the Institute, The Minories, Tower Hill. At 6.30 p.m. (Specially for juniors.) Paper on "Observation Notes on a 20,000-ton Ship with Oil Engines and Electric Propulsion," by Mr. P. J. Higgs, Wh.Sc.

Radio Society of Great Britain.—Wednesday, April 9th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Discussion on "The Use of Rectified a.c. Current as a Substitute for Accumulators and Dry Batteries in Receiving Circuits," to be opened by Mr. L. F. Fogarty.

British Horological Institute.—Wednesday, April 9th. At the Royal Society of Arts. At 8 p.m. Lecture on the "Free Pendulum," by Mr. F. Hope-Jones.

Institution of Electrical Engineers.—Thursday, April 10th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Power Circuit Interference with Telegraphs and Telephones," by Mr. S. C. Bartholomew.
(London Students' Section).—Friday, April 11th. At the Institution, Victoria Embankment, W.C. At 6.30 p.m. Presidential address by Dr. A. Russell, F.R.S.
(Western Centre).—Monday, April 7th. At the Royal Hotel, Plymouth. At 5.45 p.m. Lecture on "The Design of Apparatus for the Protection of a.c. Circuits," by Mr. A. S. Fitzgerald.
(North-Western Centre).—Friday, April 11th. At the Manchester College of Technology. At 7 p.m. Popular lecture on "World-wide Telegraphy," by Prof. G. W. Osborn Howe.
(North-Midland Centre).—Tuesday, April 8th. At the Hotel Metropole, Leeds. At 7 p.m. Annual general meeting and smoking concert.
(Scottish Centre).—Tuesday, April 8th. At 207, Bath Street, Glasgow. At 7.30 p.m. Annual general meeting.
(Irish Centre).—Thursday, April 10th. At Dublin. Ordinary meeting.

Junior Institution of Engineers.—Friday, April 11th. At 39, Victoria Street. At 7.30 p.m. Discussion on Mr. L. M. Jockel's paper on "Water Tube Boilers."

The Growth of Telephone Systems in China.

The Tientsin, North China, Installation.

By H. A. FLEET, A.M.I.E.E.

THE City of Tientsin is situated on the banks of the River Hai-ho and the Grand Canal, and may be said to be the most flourishing treaty port in North China, corresponding in importance to Shanghai in the South. It is the natural gateway to Peking, which is distant about 80 miles by rail. The native city and the foreign concessions, or settlements, are located on both sides of the river and cover a total area of over 4,000 acres. In the foreign concessions suitable wharves exist for the accommodation of steamers, for the loading and discharging of cargo, and the several municipalities, British, French, Italian, Japanese, &c., administer their own areas, the native city, which covers about 1,700 acres, being entirely under the jurisdiction of the Chinese.

Fig. 1.—Head Office, Front View.

The telephone system has been in the hands of the Chinese Government Telephone Administration since 1913, when the franchise for the concessions, or foreign settlements, was taken over from a private company and the present head office was built and put into operation. It is equipped with Western Electric common-battery manual switchboards, and has a capacity of 5,200 lines: the subscribers' instruments are of the Western Electric and Kellogg types. The main building is about 110 ft. long and 50 ft. wide, fig. 1: the battery room is situated in the basement, and two 1,600-ampere-hours capacity Chloride Electrical Storage Co.'s batteries are installed, the remainder of the basement being used for accommodating repair shops, heating apparatus, &c. On the first floor is the frame room, fig. 3, power room, and office accommodation. A 12-kW motor-generator set in the power room, fig. 2, is supplied from the French tramway power station on the 3-phase system at 380 volts. The exchange room being on the top floor, fig. 4, is a lofty and well ventilated chamber fitted with central heating for the comfort of the operators in the winter, and equipped with numerous ceiling fans for cooling, which are very necessary in the summer. The small exchange board on the extreme left communicates with the Peking exchange, and the remainder deal with the local area. The total number of employés in this exchange is about 270, including the switchboard, clerical, and repair staff. One foreign lady supervisor, whose desk is in the centre of the exchange room, is in charge of the operators, who are all Chinamen that have been trained by the Administration. In the first place they are taken on three months' probation, given living quarters and food, but no wages; during this period they are taught numbers in English and short phrases, such as "number engaged," "no answer," &c. At the end of this time they sit for an examination and, if the results are satisfactory, they are then accepted on the staff, begin to receive a wage of three dollars per month, and are installed as operators; as they become more proficient, at the end of another six months, the wage is increased to six dollars and there are periodical wage increases according to ability, until a maximum of fifteen dollars is reached. About 1919 the Head Office Exchange, which is situated in the Chinese area, near the borders of the foreign concessions, had reached its limit and a new South Office Exchange was built, distant about two and a half miles away in the British settlement. This is a handsome brick building about 130 ft. long and 60 ft. wide, fig. 5. It is also equipped with Western Electric common-battery manual switchboards for 3,000 sub-

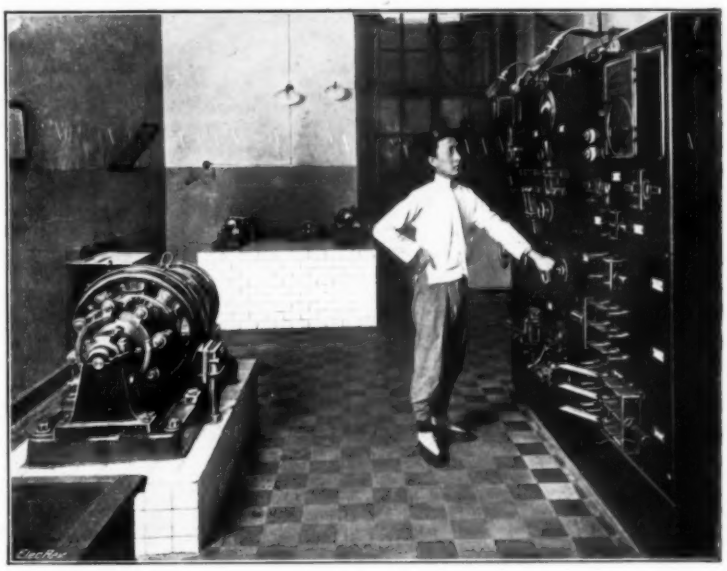

Fig. 2.—Head Office, Power Room.

scribers, fig. 7 (p. 541), and was put into service in 1921. At the west-end corner of the basement 12 cables containing 300 pairs of wires each leave

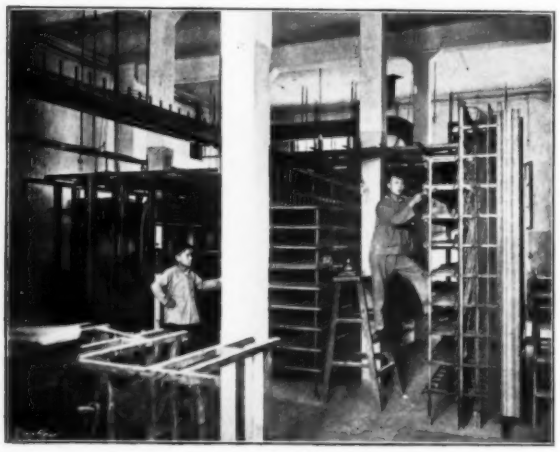

Fig. 3.—Head Office, Frame Room.

the building, and are laid in ducts, the remaining portion of the basement being used for heating apparatus, &c., and for accommodating some of the staff, of which there are about 130 employed in this exchange. Most of the interior of the building is re-inforced concrete; on the first floor are offices, together with the power and frame rooms which are combined, fig. 6 (p. 541), the door shown on the right leading into the battery room, which contains two Chloride Electrical Storage Co.'s batteries of 2,500 ampere-hours capacity each. The 12-kW motor-generator set in the power room is supplied from the British Municipal Council's power station on the 3-phase system at a pressure of 380 volts. In an out-building in the compound there is a suction gas plant, fig. 8 (p. 541), developing about 20 b.h.p. and belt-connected to a d.c. generator for charging the batteries in case of emergency. Adjacent to this building is a radio receiving station that has been recently erected, but it is not being used. Under the present system the head office serves the Chinese City, Japanese, Italian, and ex-Austrian concessions, while the south office serves the British, French, Russian and ex-German concessions. Branch offices serve Tongku and Hsien Shui Ku, while the toll lines to Peking number eight, those to Tongku three, and one serves Hsien Shui Ku. The growth of the system may be noted from the following table:—

Table I.

	End of 1913.	End of 1923.
Total number of subscribers ...	1,890	7,315
Number of conversations per day	30,880	135,690

During the past three years the increase in the number of subscribers has grown very rapidly, and it is imperative that immediate steps should be taken to make provision for early extensions. As there is only a limited amount of space available in the south office for about another 2,500 subscribers, it will be necessary to build if the manual system is to be retained and to meet the expansion of the port. Although a large number of different nationalities are served by the telephone system, in order to meet the growing needs of the port, it would be most prudent to install an automatic telephone system.

In China telephone installations are operated either by the Chinese Government, the Japanese Government, or by companies and private concerns. For the extension and improvement of the telephone system a loan was obtained in 1918 from the Sino-Japanese Industrial Corporation on the security of all telephone property, revenue, and the right of operation; together with six

Fig. 5.—South Office, Showing Base of Radio Tower at Extreme Left.

radio stations and Treasury notes. The amount of the loan was Yen 10,000,000, the interest being at the rate of 8 per cent. and the date of maturity three years.

Fig. 4.—Head Office, Exchange Room.

New Power House at Whitwood Collieries.

AT the Whitwood Collieries, near Normanton, owned by Messrs. Henry Briggs, Son & Co., Ltd., a new power house was placed in commission recently. The company

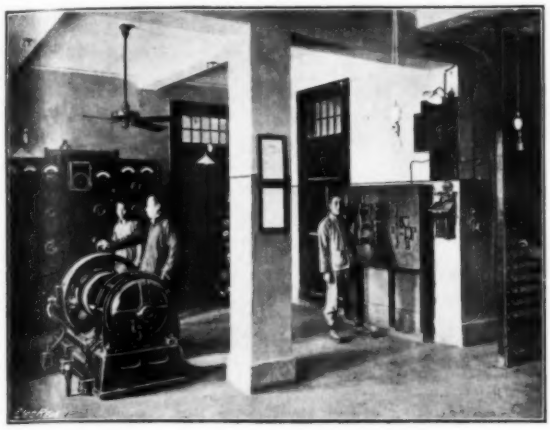

Fig. 6.—Tientsin Telephone System: South Office, Combined Frame and Power Plant Room (see p. 540).

also owns the Silkstone and Haigh Moor, Saville, Water Haigh, and Syndale pits in the district, and works some of the best seams of coal in West Yorkshire. The new power house will serve as a central generating station for supplying power to these pits; a general view appears in fig. 2, p. 542.

Although the power house as yet contains only one generating set, provision has been made for additional plant as it becomes necessary. At present there is a 2,000-kVA, 3-phase G.E.C.-F. & C. turbo-alternator (fig. 3, p. 542), a 500-kW rotary converter, a transformer, a ten-panel truck-type cubicle a.c. switchboard, and a d.c. switchboard consisting of rotary converter and feeder panels. Major D. L. Briggs, a director of the collieries, and Mr. John Bentham, M.I.A.Min.E.E., of Stoneleigh Lodge, Agbrigg, Wakefield, the consulting engineer, were responsible for the scheme, and the contract for the equipment was placed with the General Electric Co., Ltd.

It is interesting to note that electricity has been used at these pits for many years, the original installation consisting of four 112-kW, open-type G.E.C. generators, driven by Crossley gas engines, and a 200-kW E.C.C.-Kynoch set.

The general outline of the new scheme is that the power generated by the alternator is fed to the busbars of the truck-type cubicle switchboard (fig. 1, p. 542). Thence it is distributed, first, to the transformer for supplying the 500-kW rotary converter; and, secondly, for transmission by means of overhead lines to the various outlying pits. The power from the rotary converter, the d.c. voltage of which is 220/230, is used for small motors on the surface and for lighting.

The turbine is a Fraser & Chalmers standard mixed-pressure unit having a normal capacity of 1,500-kW when running at a speed of 3,000 r.p.m. It is capable of carrying full load with low-pressure steam at 16 lb. per sq. in. absolute, with a 28.5 in. vacuum. When supplied with high-pressure steam at 150 lb. per sq. in. with 150 deg. F. super-heat, a maximum load of 1,875 kW can be carried. At present the steam pressure is only 100 lb. per sq. in., and the turbine has therefore been specially designed to meet these conditions and to carry 1,500 kW under this minimum steam pressure. The turbine, which is of the impulse type, has one velocity stage and two Rateau stages in the high-pressure portion and five Rateau stages in the low-pressure portion. The rotor is of rigid design, its critical speed being well above the normal running speed, and a

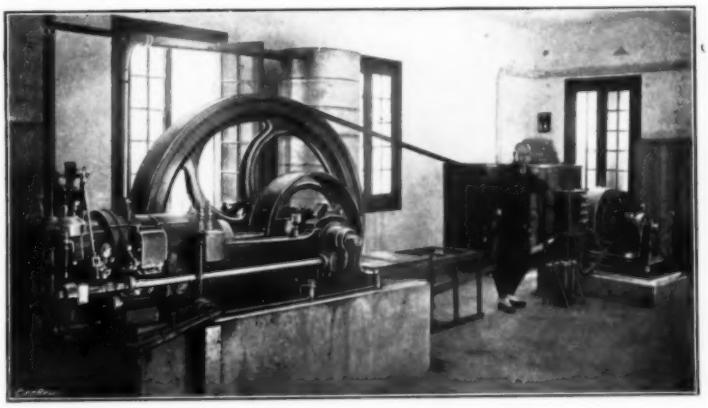

Fig. 8.—South Office, Stand by Suction Gas Plant (see p. 540).

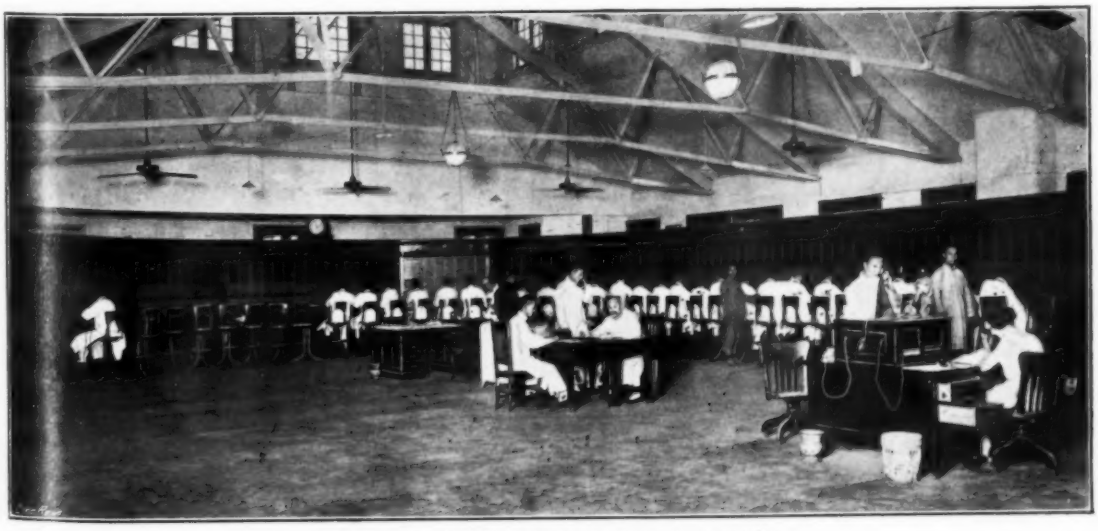

Fig. 7.—South Office, Exchange Room (see p. 540).

Michell thrust-bearing is arranged at the high-pressure end of the turbine to take up any thrust in the turbine rotor.

The safety arrangement in the turbine consists of an emergency governor of the plunger type mounted at the high-pressure end of the turbine shaft. In the event of the turbine assuming a speed 10 per cent. in excess of the normal, the emergency governor automatically closes the stop-valve by releasing the closing spring. Furthermore, the pressure oil supply to the relays is cut off, and the power cylinder connected to the drain, so that the high and low pressure throttled-valves also shut instantaneously and automatically, being spring-controlled. In addition, the emergency governor operates a vacuum breaker connected to the exhaust of the turbine.

Fig. 1.—Whitwood Collieries: Truck-type Cubicle Switchboard.

The condensing plant supplied by Messrs. Cole, Marchent & Morley, Ltd., Bradford, is of the low-level jet type, designed to deal with 40,200 lb. of steam per hour, with a vacuum of 28.5 in. The air-extraction equipment consists of two "C.M. and M.-Delas" compound steam-jet air extractors of the intermediate condenser type, in which the main steam-jet is designed to extract the air and incondensible vapours from the condenser, and maintain the required vacuum. The steam and air are discharged into a chamber in which the steam is condensed by means of a condenser water jet, the vacuum being maintained in this chamber by a secondary jet; the air and vapour passing to the secondary jet is compressed and discharged to atmosphere. It was found in early types of air extractors that stability was uncertain unless constant boiler pressures and temperatures were maintained, but the "C.M. & M.-Delas" type, owing to the diffuser tubes for both the main, and secondary jets being water-jacketed, are quite stable within wide limits of boiler pressures, temperatures, and all loads. These extractors have no critical point, whilst at the same time their simplicity of design and economy in working are very marked. The cooling water required by the extractors is taken from the injection water pipe, so that an independent supply is only required for starting up. The extraction pump is of the centrifugal type, driven by a 72-h.p. motor, at 720 r.p.m.

The alternator, which, as already stated, is rated at 2,000 kVA, runs at 3,000 r.p.m. generating at a pressure of 3,300 volts, 50 cycles. The machine embodies the usual features associated with high-speed electrical machinery. The rotor is constructed from a solid steel forging, the slots being milled to take the necessary windings, which are insulated with the highest grade of mica and other materials, and firmly kept in position by steel wedges which are driven in the top of the slots. These wedges are then enclosed by steel shrouds, which are shrunk on at both ends of the rotor. The stator consists of the usual casting bored to take the stampings in which the windings are placed. The end windings are solidly supported against stresses. The alternator is protected by the usual G.E.C. generator protective apparatus (McColl patents).

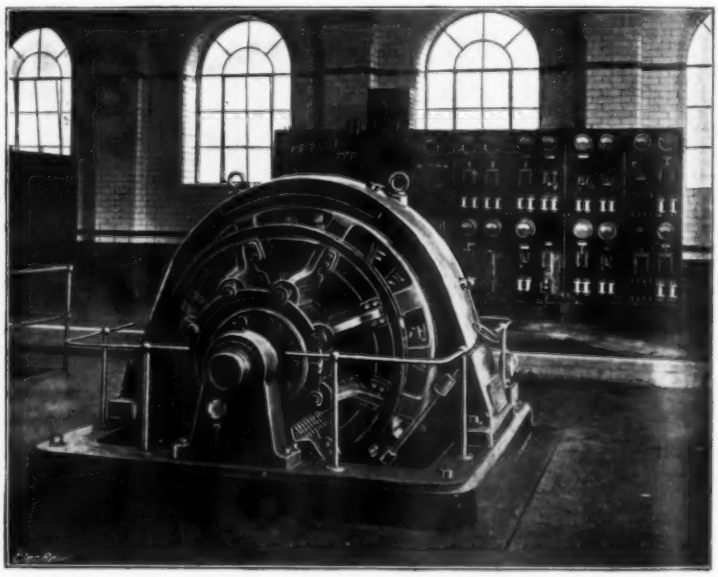

Fig. 3.—2,000-kVA, 3-phase, G.E.C.-Fraser and Chalmers Turbo-generator.

The rotary converter is of the standard G.E.C. pattern, designed for reactance control, and is self-

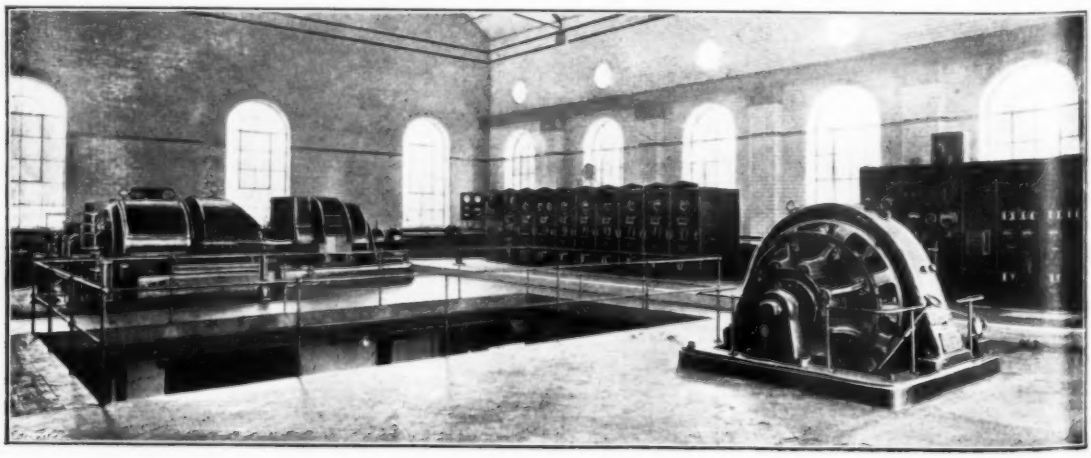

Fig. 2.—General View of Power House.

synchronising. The method of starting is extremely simple, and possesses certain important features amongst which may be mentioned, first, the fact that the windings of the starting motor are not kept in circuit during running, external reactances being provided; and, secondly, it is impossible for the attendant to perform the necessary starting operations in any but the correct sequence.

The system of supply is 3-phase e.h.p. both overhead and underground.

The supply to the basin for pumping purposes was carried out through the colliery yard with 3,300-V cable, laid in a specially prepared trench, and then carried forward by an overhead system to the pump house. The transmission line comprises red fir creosoted poles of "H" formation for 6,600 volts, the working pressure being 3,300 volts. The underground cable is connected to the overhead lines by means of the latest type of outdoor pole-mounted trifurcating boxes, and protected by outside 6,600-V, horn-type lightning arresters and choke coils. Each of the poles is equipped with double bar guards, fully earthed by mechanical connections to the continuous earth wire.

From the power house across the colliery sidings an 11,000-V cable is run, laid in the specially prepared trench. It goes thence to the Methley Junction Colliery (a distance of approximately 1½ miles) by an overhead transmission line on poles built of "H" formation, single bracing, the equipment being constructed for a working pressure of 11,000 V. The conductors terminate at 22,000-V type pole-mounted trifurcating boxes.

A 3,300-V cable is run to Speedwell Yard, laid in the specially prepared trench across the colliery sidings, and terminates in the sub-station whence all the colliery yard workings are supplied. In the same trench an 11,000-V cable is run for the linking up of the overhead transmission line to the Don Pedro Colliery, the overhead line in this instance being for 11,000-V working pressure, and in every respect similar to the transmission line to Methley Junction. Each of the overhead transmission lines is so built that a duplicate set of overhead feeders can be installed for the various extensions which it is proposed to carry out in the near future.

The whole of this work, construction of overhead lines, laying of the underground cables, jointing, &c., has been carried out under the personal supervision of Mr. J. Banks, A.M.I.E.E., Engineer of the Craven and District Electrical Construction Co., Ltd., under the supervision of Mr. John Bentham. The underground cables were supplied by Messrs. W. T. Glover & Co., Ltd., and the Macintosh Cable Co., Ltd.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

Phillips' quick-setting cement.
Nokol oil fuel (American).
A fireproof handlamp for use in bakers' ovens.

Notes.

The Largest Diesel Ship.—The largest vessel to be driven by Diesel oil engines has been ordered by the Union Castle Mail Steamship Co., for its South African service. She will be a 20,000-ton twin-screw passenger liner, built by Harland & Wolff, Ltd., at Belfast, and equipped with two sets of double-acting, eight-cylinder Diesel engines, developing approximately 20,000 indicated horse-power. Pumps for circulating water and oil will be electrically driven, as will all the auxiliaries. Electricity will be available for heating and cooking.—*Science Service.*

Disclaimer.—With reference to statements made in the House of Commons, and contained in our Parliamentary correspondent's report appearing in the Electrical Review of March 28th (p. 519), we have pleasure in giving publicity to the following disclaimer issued by the Western Electric Co., Ltd.:—

"The Management of the Western Electric Co., Ltd., London, has had its attention called to a question asked by Mr. Snell in the House of Commons on Wednesday, March 18th, wherein it was stated that the company continued to victimise a number of their workpeople who were locked out during the engineering dispute of 1922.

"The company has to state that a number of men left their employ of their own accord, during the lock-out, and have not been re-engaged, but have found work elsewhere. The management welcome the fullest investigation by any authorised body regarding the personnel, conditions, and wages paid to workpeople who are in their employ."

The Electroplating and Welding of Aluminium.—The connection between electroplating and electric welding does not consist in any similarity of the processes involved, but in the fact that progress in both processes has proceeded along parallel lines. It is some two years since aluminium was first plated at the University of Toronto, and a new process has been patented in Germany. Considerable interest attaches, therefore, to an address which was delivered to the American Electroplaters' Society in Toronto recently by Mr. J. T. Burt-Gerrans, Professor of electrochemistry at the University of Toronto. The method was described by the lecturer as follows:—"Ordinary rolled sheet aluminium plates, after being scratch-brushed with a steel brush, were first suspended as anodes in a solution of sodium hydroxide of about 2 per cent. strength at a temperature of from 25 to 35 degrees Cent., and a current of about 23 amperes per square foot was allowed to flow for twelve minutes at from 28 to 36 volts. They were then transferred to an ordinary copper cyanide bath, and were plated for three minutes with a current of 2½ amperes per square foot at 1¾ volts. The coating was finished in an ordinary cold copper-sulphate bath in the usual manner.

"After plating the specimens were tested for adherence by bending, hammering, scratch-brushing with heavy pressure, filing, and scratching with a knife. Some were heated in an oven to as much as 345 degrees Fahr. before the tests. They were then put away loosely in a drawer for nearly two years, when the scratch-brushing was repeated. This, of course, was copper plating, but the capable plater will readily adapt himself to the deposition of nickel or other metals after acquainting himself with the process whereby copper was successfully deposited. If plating can be successfully accomplished on sheet aluminium, which is always exposed to the risk of being bent or sprung, it can assuredly be done on aluminium castings, which are not liable to be subjected to anything of the kind."

Aluminium can be soldered but not very successfully, and since it was first used the greatest difficulty has been experienced in joining pieces together either by soldering with some other metal or alloy or by autogenous welding. Welding aluminium is necessary not only in repair shops, but in factories which make aluminium hardware. Kettles and tea pots, for instance, may be rolled, stamped, and welded, while the spout is cast. The oxy-acetylene blowpipe is successfully used now. Absolute purity of the oxygen and acetylene is necessary because of the high temperature which is necessary. The objection stated against oxy-acetylene welding is that it is frequently found that the pieces have run together only on the surface. With the electric arc the heating effect is, however, much more local. Speaking at the Institution of Electrical Engineers some two years ago, Mr. F. J. Heyes stated that for successful arc welding it was essential to have a costing of flux on the outside of the electrode, as otherwise the aluminium passing from the electrode to the work became so thickly coated with oxide that a very large quantity of flux would be required to deal with it. In welding iron or steel a current of about 80 amperes is required for a plate about ¼ in. thick, using a No. 8 electrode, but to weld a similar sheet of aluminium satisfactorily it is necessary to use about 150 amperes. When the plates being welded are cold, it is impossible to weld with a smaller current, but if the work be preheated to about 400 degrees Cent., a good weld may be made with about 60 to 80 amperes. As the melting point of aluminium is only 500 degrees Cent., it does not require so intense a heat to keep the point that is being welded above this temperature if there is only about 180 degrees Cent. difference between it and the surrounding portions of the material.

The welding current should increase with the thickness of the plate; for ⅛ in. thickness from 120 to 130 amperes are required, for ¼ in. from 140 to 150 amperes. The reason for this is that with a thick plate there is a greater section to conduct the heat away from the molten pool under the electrode than there is with a thin one.

International Transport Congress.—The nineteenth international congress of tramways, local railways, and public automobile transport is to be held at Paris from June 16th to 22nd. The opening meeting is to be held at the Sorbonne on June 17th, and later meetings at the Salle des Ingénieurs Civils. Intending participants should communicate forthwith with the Secrétariat de l'Union Internationale, 15, Avenue de Toison d'Or, Brussels.

New French Electric Vehicles.—The Société des Automobiles Berliet, of Lyons, has recently added a series of electric vehicles to its productions. Three types are being made, for loads of, respectively, 5 tons, 15 cwt., and 7 cwt. In general lay-out, the vehicles follow the lines usually adopted in petrol machines, the electric motor being located under a bonnet at the front of the chassis and driving through a two-speed gear box and propellor shaft to the back axle, a worm drive being employed on the larger machine and bevel gear on the two light vans. The battery—which can be either of the lead-plate or nickel-alkali type—is slung under the centre of the chassis.

Bellini-Tosi Radio Direction Finders.—In a paper which he read recently before the Wireless Section of the Institution of Electrical Engineers, Commander J. A. Slee, C.B.E., R.N. (Ret.), M.I.E.E., gave an account of the various sources of error which have been encountered during the development of the Bellini-Tosi system of direction-finding as an aid to navigation in the British mercantile marine, and pointed out that the errors can be isolated and their causes removed one by one. The application of the instrument to the purposes of navigation is also dealt with, and the possible errors, external to the ship, which may be encountered are considered, a table being attached showing the high degree of accuracy which has now been attained. It is well established that the errors of a Bellini-Tosi direction-finder need never exceed 1 deg. The outstanding point is that a direction-finder takes great circle bearings relative to the keel line of the ship, which must be converted into true mercatorial bearings before they are of any use for navigation. Bearings at distances of over 50 miles are not, as a rule, of any great service, and over 100 miles they are only a rough guide. This is not because of the liability to error being increased, but because the fix so obtained is so very rough in comparison with older-established methods of navigation. The position is considerably improved when a gyro-compass repeater is installed in the radio room. In such cases a "true bearing indicator" is fitted whereby the bearing is read off on the face of the repeater instead of on the direction-finder scale, and the true bearing can be arrived at in one operation. Measurement of "direction" is, in fact, a measurement of the direction in which the plane of the advancing wave-front lies, and "land effect" and "night effect" are the common manifestation of wave distortion. Night effect is generally accompanied by an unusual "woolliness" of zeros, but there is nothing to warn the observer of land effect except the general track of the wave when laid off on the chart. This is the business of the navigating staff and not of the telegraphist, and more definite knowledge of the subject is required. Deep-sea navigation is not the proper zone of usefulness of a direction-finder. The typical gear described gives an ambiguous result, there being no distinction between a bearing and its complement. In order to distinguish this point, instruments are now fitted with a sense-finder, which is a form of the ordinary "heart-shape" receiver, but the diagram is by no means true and the zero not as a rule good, and it is only used as an indication.

It is doubtful whether sense-finding is of much real use for fixing the position of a ship, but it is very useful when working through cross-traffic in fog, and has sometimes been of great value in helping to pick up a vessel in distress which has been badly out of her reckoning. Bearings taken of continuous-wave stations are very crisp and clear, but the wandering due to "night effect" takes place at times to so great an extent as to make bearings of continuous-wave stations quite useless for navigational purposes.

Structure of the Atomic Nucleus.—In interpreting the results of their experiments on the disintegration of certain light atoms by the impact of alpha particles, Rutherford and Chadwick have supposed that the alpha particle transfers its momentum by direct impact to a proton which is a satellite to the rest of the nucleus. In a paper on the "Structure of the Atom Nucleus and the Mechanism of its Disintegration," by Dr. Hans Pettersson, Göteborgs, Högskola, Sweden, that was recently read before the Physical Society of London by Dr. J. H. Vincent, in the absence of the author, arguments are put forward for an alternative hypothesis which assumes that the α-particle exercises a trigger-action, precipitating an explosion of the nucleus which is supposed to have only a limited stability in the case of each of the elements.

In the subsequent discussion, Prof. C. N. da C. Andrade suggested that the time seemed hardly ripe for a decision between the two theories, especially as the distinction between them was mainly a question of words at the present stage. The α-particle must exercise some kind of trigger-action in the cases under discussion, but whether the released proton came from inside or outside the nucleus was mere speculation. The satellite hypothesis was merely tentative in the absence of sufficient experimental knowledge, and the claim that the explosion hypothesis made it possible to preserve Coulomb's law counted for little, since Coulomb's law could not account for the stability of a nucleus composed of positive and negative charges, which, when free, would be about as large as the nucleus itself. The new information brought forward was that, it was claimed, the nuclei of Be, Mg, and Si underwent disintegration on bombardment. If this was confirmed, it was, of course, important, but it furnished a poor basis for the load of speculation.

Dr. J. H. Vincent thought that if it should turn out that the view advocated in the paper was true, and that all atoms were liable to disintegration, it would provide a simple explanation of a very puzzling circumstance in connection with the possibility of deriving all the elements from some parent source. If an H-particle could be removed by bombardment from a member of a radio-active series, the residual nucleus might still be radio-active, and would then take its place in another radio-active family, such that its members would have atomic weights distinguished from those of the family to which it originally belonged by the remainder, on dividing by 4, being one less than for the original series. Thus an isolated radio-active atom would give rise to a pure progeny, while a collection of radio-active atoms originally all belonging to one family would become contaminated by the other three families possible on this hypothesis.

Capt. C. W. Hume explained that if the impact of α-particles had a trigger effect on light atoms, a similar effect might be expected when α-particles impinged on heavier nuclei known to be unstable or explosive, *viz.*, those of radio-active elements. In this case should not the rate of decay of such elements be increased by bombardment? It would be difficult to detect so small an effect, but such an experiment would throw light on the question raised by the author.

Educational.—Melbourne Technical College.—We have received a copy of the 1924 prospectus containing particulars of courses, *personnel*, scholarships, &c.

Plymouth.—A full faculty of engineering, including departments of mechanical, electrical, marine, motor, aeronautical engineering, and naval architecture is proposed to be set up at Plymouth as the result of the Corporation's association with the University College at Exeter in a scheme which has for its ultimate object the establishment of a university for the South-West.

Local Society.—Irish Water Power.—In an address at the Dublin Rotary Club on "Hydro-Electric Progress," Mr. Louis Lawless, consulting engineer, referred to the success of a scheme at Birr, King's County, costing £17,000, and catering for 200 customers, and said that at Mountrath, Queen's County, a water-power scheme had been working for the past two years, while similar success had attended a scheme inaugurated at Ballaghadereen, Co. Mayo, in 1915.

Mr. J. E. Eason said they would gain enormously by such schemes, and approval of small schemes was also given by Mr. R. N. Tweedy.

Major Bryan Cooper, a member of the Free State Parliament, said that if their railways were developed by electric power they would have cheaper transit.

A New Crime.—An Irish correspondent recently sent us the following note:—"Two young men, who gave their names as Bertie Shirgo and Jack Horowes, of Dublin and London, respectively, were arrested last week in Enniscorthy, County Wexford, on a charge of having committed a sacrilege in Kenmare, County Kerry. They travelled in a motor van and sold electric bulbs through the country." Had they been encroaching upon the holy ground of certain lamp patents?

Large Malayan Contract.—The Kuala Lumpur correspondent of the *Financial Times* reports that the local Government has decided to place immediate orders at home for large electrical plant for Kuala Lumpur, estimated to cost over $2,000,000, thereby replacing the existing plant now carrying a dangerously high load. The plant will be run as a Government commercial undertaking under the advice of Mr. A. H. Preece, one of the Government consulting engineers. Mr. Preece estimates that nine months will be necessary to execute the order for plant, but public opinion is that by home manufacturers doubling their efforts it might be done sooner. Of all matters the development of electric power in Malaya is at present engaging most attention, and the industry is likely to assume large proportions in the near future, especially on the return of several Malay rulers and officials from Wembley.

Portable Battery-Charging Plant.—The charging of electric truck batteries within a reasonable distance of the scene of their operations is often a problem of some difficulty. In this connection the portable plant marketed by Messrs. Hesco, Ltd., has been found very useful; the outfit is mounted on an electric or any other type of lorry in order that, instead of the trucks being taken to the charging plant, the latter may be brought to the trucks. The power plant consists of a 25-h.p., 4-cylinder petrol engine coupled direct to a 15-kW generator, a cooling water pump and radiator fan being fitted. The generator will give 300 A at 30/50 V, at 1,000 r.p.m., and on the enamelled-slate switchboard are mounted an ammeter, voltmeter, main d.p. knife switch, tubular s.p. fuses, and a cut-out, while the shunt field regulator is operated by means of a hand wheel from the front of the switchboard. The outfit is capable of charging 12 truck batteries at the same time.

Appointments Vacant.—Electrical clerk of the works (£6) for the Southwark Board of Guardians; telegraph foremen (£400) for the Government of the Gold Coast Post and Telegraph Department; technical assistant engineer (£400) and assistant meter superintendent (£305) for the Edinburgh Corporation Electricity Supply Department; switchboard attendant for the Walthamstow Council's electricity works; electrical engineer for the Ashford (Kent) Urban District Council; temporary draughtsman for the Maidstone Corporation electricity works. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—At the ordinary meeting, on March 27th, a portrait of the late Mr. Willoughby Smith, a past-president of the Institution, was on view. The president announced that this had been presented to the Institution by Mr. Smith's two sons, Messrs. S. Willoughby Smith and W. O. Smith.

It was also announced that the Privy Council had approved the alteration of By-law No. 9 to permit corporate members to describe themselves as "chartered electrical engineers."

Lt.-Col. H. E. O'Brien, D.S.O., then read his paper on "The Future of Main-Line Electrification on British Railways," which we reproduce, in abstract form, in this issue. The author concluded his reading by exhibiting a number of lantern slides illustrating the latest types of steam and electric locomotives. The respective weights of these were said to be 149.8 tons and 107 tons, the weight per foot run being 2.13 tons and 1.73 tons respectively.

NORTH-MIDLAND CENTRE.—The following nominations for the election of members to fill vacancies arising on September 30th, 1924, have been made by the Committee:—*Chairman*: T. B. Johnson, superintending engineer to the Post Office (North-Eastern District), Leeds. *Vice-Chairmen*: S. Derwen Jones, borough electrical engineer, Batley; W. E. French, head of the Electrical Engineering Department, The University, Leeds. *Hon. Secretary*: John D. Bailie, C. A. Parsons & Co., Ltd., Leeds. *Committee*: S. E. R. Beecroft, Callender's Cable & Construction Co., Leeds; D. E. Bell, chief engineer, Yorkshire (West Riding) Electric Tramways Co., Ltd., Wakefield; R. D. Fairclough, R. D. Fairclough and Co., Leeds; H. C. Fraser, Yorkshire Electric Power Co., Leeds; F. S. G. Hinings, British Electric Transformer Co., Harrogate; J. E. Storr, mechanical and electrical engineer, Leeds.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

We learn that Mr. W. J. WILLIAMS, M.I.E.E., M.Am.I.E.E., the engineer-in-chief and manager of the Penang Municipal Commission Electric Supply and Tramways Department, and resident engineer and manager of the Penang Hills Railway, is arriving in England early this month. He will spend some time at the British Empire Exhibition, and hopes to visit manufacturers' works in connection with various plant that is required. Communications may be addressed to him c/o Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, Westminster.

Canterbury Board of Guardians has appointed Mr. S. PERRY as electrician for the ensuing half-year.

Mr. P. J. PYBUS, managing director of the English Electric Co., Ltd., and Liberal candidate for the Shipley (Yorkshire) Parliamentary Division, has accepted a challenge to public debate, issued by Mr. W. Mackinder, the sitting Socialist member of Parliament. Mr. Pybus has imposed the condition that there shall be guarantees that the debate shall be conducted with absolute fairness, and that he shall receive a quiet hearing.

To celebrate the completion of 50 years in the service of the Glasgow Corporation, Mr. R. B. MACCALL, treasurer and secretary to the Electricity Department, was entertained at a complimentary dinner at the Dalmarnock Power Station on Tuesday last week. Proposing the toast of "The Corporation of the City of Glasgow," Sir T. O. Callender referred to the commercial development of the city, and Bailie Kerr, who replied, said the Electricity Department was not one of the oldest Corporation departments, but during the 31 years of its existence it had made very great progress indeed. Mr. R. B. Mitchell, manager of the Department, who presided, proposed the toast of "The Guest," and, on behalf of the Committee, department officials and friends, presented Mr. Maccall with a diamond scarf pin as a token of esteem. Mr. Maccall returned thanks. Among other speakers were Mr. W. W. Lackie, former chief engineer of the department, Mr. D. MacKellar Dewar, and Sir John Lindsay.

Mr. J. H. NOBLE has relinquished his position as sales engineer for Messrs. Siemens Bros. and the English Electric Lamp Co., Ltd., and is becoming a director of a new company, the Electro-Mechanical Supplies, Ltd., wholesale factors, of Coventry.

Mr. J. A. BEVERIDGE, one of the original members of the Edinburgh and District Radio Society, has been appointed engineer in charge at the Edinburgh wireless station.

Mr. C. W. NEELE, M.I.E.E., M.Inst.T., M.I.R.S.E., who has been chief electrical engineer to the Great Central Railway for nearly 26 years, retired from the service of the

Elliott & Fry.] [*London.*

MR. C. W. NEELE, who has retired from the post of Chief Electrical Engineer to the Great Central Railway.

London & North-Eastern Railway as from March 31st, but his services are being retained as consultant on electrical engineering matters for a further three years.

The Sheffield Corporation Watch Sub-Committee has recommended that Mr. J. F. COLQUHOUN, assistant to the Inspector of Lighting at Glasgow, be appointed lighting engineer for Sheffield, at a salary of £500. According to the *Sheffield Independent*, Mr. Colquhoun will have complete charge of the street lighting of the city, and will have to adviso on projected alterations and developments in both gas and electrical illumination.

Manchester City Council has received a request from the Sydney (New South Wales) Municipal Council asking for the services of Mr. S. L. Pearce, the city electrical engineer and manager, to advise on the Sydney electricity undertaking. The Electricity Committee recommends that the request be granted, and the necessary leave of absence to Mr. Pearce be granted.

Obituary.—PROF. W. J. LYONS.—The death is reported of Prof. W. J. Lyons, president of the Radio Association of Ireland.

New Companies Registered.

Radio Intelligence, Ltd. (196,556).—Private company. Registered March 20th. Capital, £100 in £1 shares. To carry on the business of proprietors and publishers of newspapers, journals, magazines, books, and other literary works and undertakings dealing with radio-telegraphy, radio-telephony, submarine signalling, or other methods of radio communication, &c. The first directors are:—B. Binyon, O.B.E., "Hawthorndene," Hayes Common, Kent (managing director of Radio Communication Co., Ltd., and director of Mullard Radio Valve Co., Ltd., C. F. Elwell, Ltd., and London Radio College, Ltd.); Brig.-Gen. Ronald M. Johnson, C.M.G., D.S.O., Crown Cottage, Addlestone, Surrey (director of Radio Communication, Co., Ltd.). Qualification, £1. Remuneration as fixed by the company. Solicitors: Amery-Parkes & Co., Effingham House, Arundel Street, Strand, W.C. Registered office: 34-5, Norfolk Street, Strand, W.C.2.

Radio House, Ltd. (196,545).—Private company. Registered March 20th. Capital, £1,000 in £1 shares. To carry on the business of electrical and motor engineers and contractors, suppliers of electricity, carriers of passengers, manufacturers, importers and exporters of, agents for, and dealers in rail and tramway appliances and telegraphic and telephonic and wireless apparatus, &c. The first directors are:—Lt.-Col. J. Evans, D.S.O., T.D., D.L., J.P., "Beaumont," Blackwood, Mon.; C. W. Liles, "Helena," York Place, Newport, Mon. Secretary: W. H. Liles. Solicitor: J. M. B. McCavan, Westgate Chambers, Newport, Mon. Registered office: 17, Union Street, Plymouth, Devon.

Radio Productions (Leeds), Ltd. (196,628).—Private company. Registered March 22nd. Capital, £2,500 in £1 shares. To acquire from M. E. Peartree and J. A. Brabbs the business of wireless electrical engineers carried on by them at 107, Portland Crescent, Leeds, as "Radio Productions." The first directors are:—M. E. Peartree, 107, Portland Crescent, Leeds; L. Nicholson, 15, Springfield Mount, Leeds; J. A. Brabbs, 14, Manor Road, Leeds (all permanent, subject to holding £300 shares). Qualification of directors, £100. Solicitor: A. E. Masser, The Chambers, 7, Park Square, Leeds. Registered office: 107, Portland Crescent, Leeds.

Audible Advertising, Ltd. (196,669).—Private company. Registered March 25th. Capital, £5,000 in £1 shares. To acquire the rights to operate the audible advertising scheme originated by Lloyd Raby Rees, to acquire the benefit of certain arrangements between the said L. R. Rees and the Western Electric Co., Ltd., and to carry on the business of advertising contractors and agents, manufacturers of advertising apparatus and appliances, electrical sound amplifying equipment, electrical engineering and wireless equipment, &c. The first directors are:—F. B. Smith, "Dun Withins," Heaton, Bolton, architect and surveyor; J. Kilroe, "Grindlewood," Lostock, Bolton, provision merchant; L. R. Rees, Bagenden Rectory, Cirencester, Glos., engineer; J. A. A. Taylor, 201, Warbreck Drive, Blackpool, solicitor. Qualification, 50 shares. Secretary and solicitor: J. A. A. Taylor, 9, Chancery Lane, Bolton. Registered office: 9, Chancery Lane, Bolton.

Engineers (Wales), Ltd. (196,679).—Private company. Registered March 25th. Capital, £1,000 in £1 shares. To carry on the business of electrical and mechanical engineers, contractors for cold storage insulation, including the covering of brine and ammonia pipes, contractors for sound-proofing and fireproofing buildings, iron, brass, and general metal founders, &c. The permanent directors are:—A. F. Rankin, Castle Buildings, Swansea; Dr. S. G. Norris, J.P., "Brynydelyn," Mardy, Glam. Qualification, £250 shares. Secretary: A. F. Rankin. Solicitor: H. E. John, 15, Cowell Street, Llanelly.

Electrical and Chemical Ebonite Co., Ltd. (196,618).—Registered March 22nd. Capital, £30,000 in 15,000 "A" ordinary, and 10,000 "B" ordinary shares of £1, and 60,000 "A" deferred shares and 40,000 "B" deferred shares of 1s. To acquire from Meyer Wilderman certain rights with regard to inventions relating to a process of manufacture of porous ebonite; to adopt an agreement with the said M. Wilderman and H. Terrell to carry out experiments in actual manufacture and to explore every branch of the electrical and chemical fields to which the said inventions can be applied, to manufacture and deal in rubber, vulcanite, and celluloid goods, &c. Minimum cash subscription, £15,000. The first directors are:—M. Wilderman, 72, Fellows Road, Hampstead, N.W., chemist; H. Terrell, 20, St. James' Square, S.W., civil engineer; and others to be appointed by the subscribers. M. Wilderman is entitled to appoint one additional director. In the event of M. Wilderman, or the director appointed by him, ceasing to be a director, the holders of a majority of the "B" ordinary and "B" deferred shares may appoint a successor. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, Strand, W.C.

Austin Walters & Son, Ltd. (196,570).—Private company. Registered March 21st. Capital, £3,000 in £1 shares. To acquire the business carried on by A. Walters at the Gaythorn Electric Works, Little Peter Street, Manchester, as Austin Walters & Son, to acquire the right to use or manufacture and put up telephones, telegraphs, phonographs, dynamos, accumulators, lamps, and all apparatus connected with the generation, supply, and employment of electricity, or any power used as a substitute therefor, and to carry on the business of electricians, mechanical engineers, and manufacturers, workers of, and dealers in electricity, &c. The first directors are:—A. Walters, 180, Ayres Road, Old Trafford, Manchester, electrical engineer; W. Walters, 119, Russell Street, Moss Side, Manchester, electrical engineer (both permanent, subject to holding 100 shares each). Secretary: W. Walters. Solicitor: W. J. Sharratt, 89, Fountain Street, Manchester. Registered office: Gaythorn Electric Works, Little Peter Street, Manchester.

Acme Electric Wire and Cable Co., Ltd. (196,546).—Private company. Registered March 20th. Capital, £1,000 in £1 shares (100 6 per cent. cumulative preference and 900 ordinary). To adopt an agreement with L. A. Thomson and to carry on the business of manufacturers of electric wire as formerly carried on by him at Shardlow, Derbyshire. The first directors are:—H. L. L. Greaves, 30, Glaybury Road, West Kensington, W.14, chartered accountant; L. A. Thomson, The Wharf, Shardlow, near Derby, electric wire manufacturer (both permanent, subject to holding 200 ordinary shares). Qualification of directors, £100. Remuneration, one guinea per annum. Solicitor: Noel Foskett, 10, Bush Lane, Cannon Street, E.C.4. Registered office: 11d, Regent Street, S.W.

Portland Stores, Ltd. (196,596).—Private company. Registered March 21st. Capital, £500 in £1 shares. To carry on the business of manufacturers, dealers, sellers, makers, and repairers of wireless, telegraphic, telephonic, and electrical apparatus and appliances, and perambulators, motor-cars, motor-cycles, cycles, cameras, photographic and motor accessories, gramophones, gramophone records and accessories, sports and athletic goods, theatre tickets, general merchants and makers of "Sunbrite" carried on by B. C. Innes as the "Portland Stores," at 84, High Street, Marylebone. The first directors are:—B. C. Innes, 18, Downside Crescent, Hampstead, N.W.; Mrs. Lilian Innes, 18, Downside Crescent, Hampstead, N.W. Qualification, £100 shares. Remuneration, £5 each per annum. Secretary: B. C. Innes. Solicitors: Rubinstein, Nash & Co., 5 and 6, Raymond Buildings, Gray's Inn, W.C.1. Registered office: 84, High Street, Marylebone.

Official Returns of Electrical Companies.

W. G. Cannon & Sons, Ltd. (87,796).—Return dated December 31st, 1923. Capital, £3,000 in £1 shares. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Joseph Evans & Sons (Wolverhampton), Ltd. (95,446).—Return dated December 14th, 1923. Capital, £125,000 in £1 shares. 113,508 shares taken up. £13,508 paid. £100,000 considered as paid. Mortgages and charges, £50,000.

Dartmoor Electric Supply Co., Ltd. (110,871).—Return dated December 14th, 1923. Capital, £2,000 in 10s. shares. All shares taken up. £2,000 paid. Mortgages and charges, £4,000 at 4½ per cent.; £3,950 second debentures at 6 per cent. (£3,550 held by bank as collateral security).

Luminograph Co., Ltd.—Particulars filed of £1,500 debentures authorised March 14th, 1924, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £1,000.

Cutting Bros., Ltd.—Particulars filed of £12,000 debentures authorised March 6th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Hindhead and District Electric Light Co., Ltd.—Issue on March 13th, 1924, of £250 already registered.

Aerophones, Ltd.—A. C. Turtle, of Blomfield House, London Wall, E.C., ceased to act as receiver on March 13th, 1924.

Parkinson and W. & B. Cowan, Ltd.—Notice is given that the sub-mortgage dated February 1st, 1908, created as additional security for the debenture stock secured by trust deed dated April 2nd, 1901, and the mortgage dated August 31st, 1913, also created as additional security for the debenture stock covered by the said trust deed and the first supplemental trust deed of June 25th, 1914, were satisfied by the property comprised in the sub-mortgage and mortgage respectively, being sold by the company and released by the trustees by a conveyance dated January 25th, 1918. Also satisfaction in full on October 30th, 1922, of debenture dated June 25th, 1914, securing £99,960. (Notices filed March 20th, 1924.)

Midget Lamp Co., Ltd.—L. Jacobs, M.B.E., of 3-5, Queen Street, Cheapside, E.C., was appointed receiver on March 17th, 1924, under powers contained in first mortgage debentures dated April 8th, 1915, and October 5th, 1918.

K. H. E. Ignition Co., Ltd.—A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, and 53, Victoria Street, Westminster, S.W.1, was appointed receiver and manager on March 13th, 1924, under powers contained in first debenture dated December 15th, 1922.

City Notes.

Yorkshire (West Riding) Electric Tramways, Ltd.

This company, whose report was dealt with in our last issue (p. 507), held its annual meeting on March 28th, Sir Herbert S. Leon presiding. In the course of his remarks, the chairman referred to the formation of a separate company for the omnibuses in November last, and said that on this account comparison with previous years was difficult. He said that "piracy" was rampant and that it was hoped that legislation would soon be introduced to confine the granting of licences to those who could give a full-day service. During the year a commencement had been made with the improvement of the depôts at Wakefield and Castleford. The results from the Pontefract lighting undertaking had been satisfactory, and he wished that its operation were not perforce confined to the Borough of Pontefract. The balance over-expended, shown in the accounts at £117,774, must remain unless the board adopted the policy of issuing fresh capital. It was hoped that this would be avoided but it was impossible to foresee how such an industry would develop. With the exception of the years 1920 and 1921, funded dividend certificates had been purchased year by year for redemption and he was glad to state that this item would now disappear from the accounts. They had succeeded in obtaining permission to abandon the construction of their uncompleted light railways which had been an incubus upon them. It was proposed, with the aid of the Unemployment Grants Committee, to proceed with the replacement of the motors of their cars by more efficient patterns.

A. Reyrolle and Co., Ltd.

The report for the year ended December 1923, shows a profit of £63,239, as against £70,740 for 1924. Adding £16,570 brought forward, the available profit is £79,809. After meeting the preference dividend, 7 per cent., and paying 12½ per cent. per annum on the ordinary shares, £25,000 is put to reserve for general purposes, including equalisation of dividends, leaving £17,009 to be carried forward. The extensions to the works were not completed until 1924, so that they were not available for production during the year under review. The expenditure on account of these extensions and the necessary plant and equipment to December, 1923, was £110,002. "Competition for orders has been very severe, but . . . full employment has been maintained at the works throughout the year." The company's property has been maintained in an efficient state of repair, and provision has been made in the accounts for depreciation and for income tax and corporation profits tax. Meeting at Hebburn-on-Tyne to-day (Friday).

British L. M. Ericsson Manufacturing Co., Ltd.

Mr. W. M. Crowe, in the course of his speech at the annual meeting, on March 27th, said that, considering the unsatisfactory state of trade at home and abroad, the results for 1923 were satisfactory. No great improvement in trade could be expected until Europe was settled and got down to steady work. Continual strikes and limitation of output were playing into the hands of foreign competitors, and we were allowing foreigners to dump goods of all kinds into this country without asking them for a penny of recompense.

The company's trade with the Colonies continued to be satisfactory, and only the previous day it had received an order valued at nearly £100,000 from the Australian Post Office. As regarded internal trade, competition had been, and continued to be, severe, but the company was more than holding its own, and looked forward to the future with confidence. He suggested that the Post Office authorities might commence a campaign to bring the benefits of the telephone to the notice of the public. On the radio side business had been good, and the company's headphones and receiving sets had been well received. The day of cheap and inefficient material was passing, and those firms which had given the public reliable products at moderate cost would reap the reward which they deserved. Taxation continued to be heavy, and was a great handicap to the British manufacturer in the export markets. The question needed the sympathetic atten-

tion of the Government. In turning to the accounts, which were abstracted in our issue of March 21st, p. 346, the chairman said that nothing was included in the assets for the value of goodwill which the company had built up. The plant and buildings stood at a figure very much below their present-day value, thanks to the high rates of depreciation allowed in the past, together with the fact that they had been maintained out of revenue in a first-class state of efficiency. He drew attention to the fact that the whole of the undivided profits, amounting to £156,500, was employed in the business, and so helped to make profits without ranking for dividend. The ordinary dividend (10 per cent., free of tax) could have been increased, but the directors felt that their past policy of conservative dividends should be maintained.

South London Electric Supply Corporation, Ltd.

The annual meeting of this company was held on March 27th, under the chairmanship of Sir Harry Renwick, K.B.E., presenting the report and accounts (*vide* ELECTRICAL REVIEW, March 21st, p. 465), the chairman said that he had to report all-round progress—in output, revenue, and profit. The contributions to reserves and the carry-forward were being increased. Although the sales of energy had increased by practically 1¼ million kWh, the expenses had only risen by £5,451. The investments in gilt-edged securities had increased by £43,350 to £97,293. It was difficult, owing to the unsettled conditions, to forecast the results for the current year, but since the beginning of the year the energy sold had increased by 14 per cent., as compared with the equivalent period of 1922, and the applications received also showed a slight increase.

British Aluminium Co., Ltd.

The annual meeting was held on Friday last at Winchester House, Lieut.-Col. S. H. Pollen, vice-chairman, presiding. The chairman, in proposing the adoption of the report, after referring with regret to the absence of Mr. A. W. Tait, the chairman, who was recovering from a severe illness, said that the net profit for the year amounted to £362,704, as compared with £229,235 for the previous year. The trading profit was £340,626, as against £195,231, or an increase of £145,395. That result, having regard to the conditions prevailing during the year, must be regarded as satisfactory. At the commencement of the year the demand for their metal was increasing, but prices were low. As the year advanced the demand progressively improved, but prices for their larger contracts showed a relatively small increase until towards the end of the year. The net result was that, although they marketed a larger tonnage, the average prices taken were little in excess of those for the previous year. By the end of the year contract prices had reached a basis more in accordance with the costs of manufacture, and the demand showed no diminution, with a pleasing increase in the demand for the products of their rolling mills. As a result of the activity in the industry there had been some lessening of the previously severe competition. The output for the year of metal by the works operated by the company constituted a record. At the last meeting they reported that they had acquired an interest in a company in Norway having two aluminium factories which, at that time, were not in operation. One of these factories was restarted in the late spring of last year, and the second factory about the middle of the year, but it was not until towards the end of the year that both factories were brought up to full production. This year they anticipated deriving material benefit from this investment. The uses to which aluminium was put expanded in a satisfactory manner, but the principal consumers of the metal continued to be the industries which had been referred to on previous occasions. The expansion in the consumption of aluminium had followed the course of the other non-ferrous metals, and the same factors operated as to the future, with the exception that in the case of aluminium many new applications were possible, including the growing substitution of the metal for other non-ferrous metals. During the last 14 years the world's consumption of aluminium had increased approximately fourfold. This great growth in the demand for metal had not, of course, been without interruption. There had been ups and downs, but over a period demand had steadily overtaken supply, and it was their duty to look ahead for further sources of production if they were to maintain their position. As had been reported, the board had long carefully considered the Lochaber water power scheme, and was now satisfied that the time had arrived to proceed actively with the undertaking. For some time they had been in negotiation with the Trade Facilities Act Advisory Committee, and he was pleased to be able to report that the Committee had decided, subject to certain conditions, to recommend the Treasury to attach a Government guarantee to a loan of £2,000,000 for the purpose of developing the hydro-electric works. As preliminaries, however, in the first place the Trade Facilities Act, which had expired, had to be renewed, and, secondly, satisfactory agreements had to be completed with the Treasury, but they could see nothing at present that should prevent those preliminaries from being fulfilled. The intention was to complete the developments covered by the Act of 1921 in stages. The loan, together with the further capital that would have to be provided for the aluminium works would suffice only to complete the first stage. That would comprise the major portion of the work sanctioned by the Act. Moreover, in carrying out that first stage they would be in some measure providing in advance for the following stages, as certain important works would be on a scale capable of serving the complete scheme. It would be necessary to form a separate subsidiary company to carry out the financial arrangements, and they proposed to give the company's guarantee that the service fund required to meet the annual interest and amortisation of the £2,000,000 loan would be provided, and they would have, in addition, to make suitable arrangements for the provision of the balance of capital required for the erection of the necessary factories. In regard to the latter they were satisfied that such arrangements could be made—and, in regard to the guarantee, powers would be granted to meet interest out of capital during construction; the sinking fund would not begin to operate for five years, and they anticipated that by that time the plant and works would be in active operation, and the additional profit earned from the output should be sufficient to meet the interest and sinking fund and to give a return commensurate with the capital invested. It was their considered opinion that the additional tonnage the Lochaber works would produce when completed should be readily absorbed by the market. They hoped also that the active prosecution of these important works would contribute substantially to the alleviation of unemployment. In reviewing the accounts the chairman said that the board considered that the time had now arrived for the creation of a staff benefit fund, and they had consequently allocated £10,000 out of the year's profits as a commencement.

It was proposed to pay a final dividend at the rate of 10 per cent. on the ordinary shares, which would make 7½ per cent. for the year. It was satisfactory to know that the profits which had been earned for the year 1923 justified that increased dividend on the ordinary shares, and it was also satisfactory that they had been able to make an increase in the appropriations to the depreciation and reserve accounts and to inaugurate a staff benefit fund. In regard to the future, prices were now on a more satisfactory basis, the demand for all of their products was good, and they were justified in hoping that next year they would be in a position to lay before the shareholders a statement of the company's operations at least equally satisfactory. Mr. J. Taylor seconded the motion, which was carried without discussion.

Melbourne Electric Supply Co., Ltd.

The Premier of Victoria has issued a statement setting forth the Government's policy with regard to the acquisition of the properties of this company whose "franchise" expires towards the end of next year. It is pointed out that the company's single-phase system requires conversion to three-phase, and a great deal of expenditure is necessary before the end of the company's tenure, and it is probable that at that date the company's capital account will stand at approximately £4,000,000. In view of the serious nature of a financial operation of raising a sum of this magnitude within the next year or two, the Government has thought it necessary to consider an extension of the company's tenure. To this end it has drawn up a set of conditions for an extension of a maximum of 10 years with an option for the Government to purchase the undertaking in 5 or 7½ years. With the assistance of the Electricity Commission the Government has secured the acceptance of these conditions, in principle, by the company. The conditions stipulate that the company may in certain circumstances demand that the Government exercise its option of purchase at the end of five years. The sum to be paid by the Government upon acquisition of the undertaking is to be based on the original actual cost of plant less a definite percentage for depreciation for every year in which each item of the plant has been in use. This will average 3 per cent. per annum. During the extended period the company's distributable profits are to be limited to 7 per cent. on the ordinary share capital, and to 8 per cent. upon the preference capital. Any excess profits are to be applied to the reduction of charges to consumers. The company must carry out when called upon all works of conversion and extension, under Government supervision. All requirements of energy must be purchased from the State scheme when this becomes available. The company must not raise any further capital without the approval of the Government. The latter may, moreover, provide any further capital by way of loans upon which the company would pay interest. These conditions will also apply to the company's Geelong undertakings, and legislation is to be introduced to give effect to the arrangement.

Lancashire Dynamo and Motor Co., Ltd.

The directors report that after providing £8,678 for depreciation and £2,041 for debenture interest, the loss for the year ended December, 1923, amounts to £2,513. £487 was brought forward and £5,000 has been transferred from reserve; the disposable balance is therefore £2,973. The preference dividend at the rate of 5½ per cent. per annum less tax, requires £2,063, directors' fees £700, and £211 is carried forward. After making the above transfer from reserve to pay the preference dividend, the reserve stands at £55,000. It is stated that the year was again one of great difficulty and scarcity of work, but the results are an improvement on those of 1922, and the orders on hand are better than at this time last year. The company's liability for E.P.D., income tax, and Corporation Profits Tax from

1917 to 1923 is still unsettled, but full provision has been made to cover this. The death of Sir H. V. Kilvert, who had filled the position of chairman since the death of his brother two years ago, is referred to. He had been a director since the formation of the company.

Stewarts and Lloyds, Ltd.

Mr. Henry Howard presided, in the absence of the chairman (Mr. J. G. Stewart), at the annual meeting on March 27th. He said that the doubt expressed by the chairman at the last meeting as to the course of trade had been fully realised; the iron and steel trades had passed through a critical year. Although the volume of orders, expressed in tonnage, was 50 per cent. greater than that of 1922, much of the business was only obtained at prices which left no margin of profit. The plant had been extended and improved, and with a revival of trade the company would be in a position to take full advantage of the possibilities offered.

Dublin United (Electric) Tramways Co., Ltd.

An extraordinary general meeting of this company on March 27th passed a resolution approving a Bill authorising the company to maintain omnibus services in the city and county of Dublin and the counties of Wicklow and Kildare, and to amend certain Acts relating to the company. The chairman explained that they had no definite idea at present of embarking on an omnibus service, but circumstances might arise which would call for defence against private 'buses competing with their tramway service.

Cork Electric Tramways and Lighting Co., Ltd.

The directors' report for 1923 states that the revenue was £132,479, and the balance, after meeting all expenses and providing for depreciation, &c., £15,926, to which is added £3,100 brought forward, making £19,026. The interim and preference dividends absorbed £9,613; a final dividend of 3 per cent. (making 6 per cent. for the year) on the ordinary shares is recommended; and £5,963 is to be carried forward. While the tramway revenue increased that from the sale of energy decreased, making a net decrease of £1,182. £5,970 was spent on cables, house services, and a new tramway car. The installation of a new 2,000-kW set is in hand.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The annual meeting was held at Newcastle on March 25th under the chairmanship of Mr. R. P. Sloan, C.B.E. In moving the adoption of the report and accounts (*vide* Elec. Rev., March 21st, p. 464), the chairman said that in spite of the boilermakers' lock-out, there was a slight recovery from the slump in trade. Investments in associated companies had been increased by £24,380 during 1923; this included a further investment of £20,000 in the Tees Power Station Co., Ltd. During the first ten weeks of the present year the output showed an increase of 15 per cent. over that of the corresponding period of 1923. The applications for power at the beginning of the year totalled 43,452 h.p. This rapid growth of the business was a healthy sign, and from the steady flow of applications which they continued to receive there was every indication that the rate of expansion would continue for some time to come. It was anticipated that by the end of the current year the whole of the company's generating plant and distribution system would be loaded up and extensions were necessary. It had accordingly been decided to install further plant at the North Tees power station, where it could be usefully and economically employed. The development of the domestic supply business had been more than maintained, and he looked forward to a very substantial growth in this section during the next few years. The report and accounts were adopted and at a subsequent extraordinary meeting a resolution adopting new articles of association was carried.

British Insulated and Helsby Cables, Ltd.

The annual meeting of this company, whose report was abstracted in our issue of March 21st (p. 465), was held at Liverpool on March 24th. The chairman (Mr. James Taylor), in the course of his speech, said that a slightly larger profit had been made on a greatly increased turnover. They had been enabled to sell goods at reduced profit by the improvement of their factories. Every opportunity had been made to bring the plant up to date by removing obsolescent machinery, and replacing it by the latest, best, and most labour-saving appliances, as they had found—with other manufacturers—that this was the only way in which they could keep the selling price low enough to compete with foreign manufacturers. The company continued to do a fairly large export trade in cables and accessories, but many foreign markets had been closed to them by reason of local tariffs. He might especially mention Canada, Japan and, to some extent, Australia and India. The growing tendency was for each country to manufacture commodities for itself. Many countries, however, were developing electric power, and as a consequence required to buy the class of goods which the company manufactured. This might result in their export trade being continued at the same level, and the present state of the order book appeared to confirm this. The engineering and contracting departments continued to be busy. They were proceeding with a large South African railway electrification contract, and another contract of the same nature had been secured in connection with the electrification of the Great Indian Peninsula Railway. The accessory department and the wire mill had been kept continuously busy and both departments were still working at high pressure. Referring to the litigation respecting electric lamps in which the company had recently been involved, the chairman said that whatever the result of the appeal which was pending, the general business of the company would not be seriously affected. The lamp business showed satisfactory results during 1923. The business at the new cable factory in India was progressing slowly and the manufacture of copper wires and cables had been commenced. Fairly good orders had been received from the Indian Government and the prospects were satisfactory. The item "Stock and work in progress" stood at £977,972 as compared with £658,260 a year ago; this was due to the increased turnover. For the same reason the item "Sundry debtors" was also larger.

Referring to the activities of the companies in which the Helsby Company was interested, the chairman said that the Midland Electric Corporation had paid an increased dividend. The Electric Supply Co. of Victoria had secured permission to install new generators at Ballarat and Bendigo, and it was believed that the production of a larger and cheaper supply would considerably enhance the value of the property. Without anticipating the report of the Automatic Telephone Manufacturing Co., he said that a large contract had been arranged between the company and the General Post Office, which, with other business, was providing plenty of work. Referring to the increased sum carried forward, Mr. Taylor said that the trying conditions under which the business of to-day was conducted behoved them to be financially strong and to keep strong. Both classes of mortgage debentures fell due at the end of the present year; suitable arrangements would be made and ample notice given.

At an extraordinary meeting provision was made for the appointment of two new directors, Messrs. E. Taylor and G. J. Nisbett.

Agricultural and General Engineers, Ltd.

An extraordinary meeting of the shareholders is to be held on April 15th for the purpose of considering a reduction of capital. The scheme to be presented comprises the writing-down of the value of the ordinary shares by one-half to 10s. The ordinary £1 shares remaining unissued (4,246,048) are each to be divided into two shares of 10s. each. The holders of the preference shares are asked to forgo arrears of dividends upon the consideration of being allotted fully-paid ordinary shares instead. The result of this rearrangement will be to reduce the authorised capital from £8,000,000 to £6,757,184, the difference being unrepresented by assets or lost.

City of London Electric Lighting Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided at the annual meeting on March 26th. The report of the directors was reviewed in our issue of March 21st (p. 464). In the course of his speech the chairman said that their ability to recommend again a dividend of 15 per cent., was due to their conservative policy of providing capital expenditure out of revenue, so that the ordinary share capital was only £800,000 against a capital expenditure of £2,783,072. The reductions which had been made in the charges meant that the consumers received a cash equivalent of £106,851, while the distribution on the ordinary shares amounted to £92,250. In spite of the increase of about 6,400,000 kWh in the amount of energy sold, the cost of fuel had fallen by over £11,000, and further economies in generation and distribution raised this to £16,000. Mr. Braithwaite said that there had been complaints against the high rate of dividend, but it was to be remembered that in four years of the company's existence no dividend was paid, and the total of the dividends paid averaged only 7.123 per cent.—by no means an excessive return to those who showed their faith in electricity in the early days.

The total reserves of the company were as follows:—General reserve, £529,280; special contingencies, £20,007; dividend equalisation account, £60,000, representing 7½ per cent. on the ordinary shares; and the carry forward, £33,482, making a total of £642,769. £331,488 of the reserve was invested, and the rest employed in the business in various ways.

The chairman reviewed the position with regard to the reorganisation of London's electricity supply, and said that the actual details of the proposed sliding scale, sinking fund, &c., were being negotiated, and he was hopeful that these negotiations would be successful, and that the directors would be able to place terms before the shareholders which would justify their recommending the acceptance of the responsibility of maintaining and extending the supply of electricity until 1971.

The aim of all parties was so to co-ordinate the supply of electricity throughout London that the service might be adequate and capable of extension to provide for future growth of demand and might be given on the most efficient and economical basis. The East End group, to which the City of London Co. belonged, was fortunate in possessing two first-class generating stations on the River Thames. Given a satisfactory sliding scale—by which he meant one that would safeguard the interests of the consumer and would

still leave the companies with plenty of incentive to strive to extend and cheapen further the supply of electricity and would not prejudice their ability to raise on the most favourable terms the large amount of new capital which would be required in the future—he looked forward with confidence to seeing the electricity supply of London placed at last on a thoroughly satisfactory basis.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

North Metropolitan Electric Power Supply.—£32,000 5 per cent. mortgages of £100 each, Nos. 2,029 to 2,348.

The undermentioned securities have been ordered to be officially quoted:—

County of London Electric Supply Co.—500,000 ordinary shares of £1 each, fully paid (Nos. 755,781 to 1,255,780), and 500,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 2,150,001 to 2,650,000).

North Metropolitan Electric Power Supply Co.—£32,000 mortgages (registered) of £100 each, Nos. 2,029 to 2,348).

Crossley Bros., Ltd.—The scheme for the capital reconstruction of this company, outlined in our issue of March 21st (p. 465) was approved by a meeting of the shareholders on March 25th. The value of the £1 ordinary shares is to be written down by one-half, and the arrears of preference dividend are cancelled in consideration of the rate being increased from 5 to 7 per cent.

Brixham Gas Co.—At the annual meeting of the company on March 20th the directors reported a profit on the electricity account of £389. The chairman, Mr. W. A. Scott, announced that it had been decided to install a new set at the works to cope with the ever-increasing demand for electricity.

Midland Electric Corporation for Power Distribution, Ltd.—An obvious error crept into our report of this company's meeting in our last issue (p. 507). It was stated there that £120,000 was being contributed to the staff benevolent fund. The total contributed to this fund, as will be seen from our summary of the company's report, is £12,000.

Sherborne Electric Supply Co., Ltd.—The company has issued its first report, covering the three months ended December 31st, 1923. The gross profit was £61, and the addition of a balance from the contracting department and interest on deposits rendered available £313. £150 is written off the preliminary expenses, and the balance carried forward.

Mirrlees, Watson Co., Ltd.—After allowing for depreciation, directors' fees, &c., there was a balance on working for 1923 of £15,601. To this is added £4,086 brought forward, making £19,687. A dividend of 10 per cent. is recommended, leaving £5,283 to be carried forward.

Western Electric Co. (U.S.A.).—An offer in America of $35,000,000 Western Electric Co. 20-year 5 per cent. debentures at the price at 96½ and interest, New York terms, was oversubscribed.

Wood & Cairns, Ltd.—The directors, after allowing for bad and doubtful debts, declare a dividend of 7½ per cent. on the preferential shares and 5 per cent. on the ordinary shares for the year 1923.

Scottish Tube Co., Ltd.—The balance available at end of 1923 was £34,472. The directors recommend the payment of preference dividend and the carrying forward of the remainder (£13,249).

French Company.—La Société Havraise d'Energie Electrique of Le Havre, reports a net profit of 4,718,230 fr. for the last financial year as compared with only 3,393,678 fr. in 1922.

Metropolitan-Vickers Electrical Co., Ltd.—The directors have decided to recommend a dividend of 8 per cent. upon the ordinary shares. This is a reduction on the 12½ per cent. which has been paid for the last three years.

Stocks and Shares.

MONDAY EVENING.

STOCK EXCHANGE markets had not heard the result up to the time of closing this (Monday) evening of the ballot which was taken of the transport workers. Therefore the effects of the strike are still partially apparent in quotations, though the fall which overtook Districts, Underground income bonds, and a few others was recovered to a large extent. For instance, Underground income bonds which were 97 last week, dropped to 93 before recovering to the present price of 96, and Districts from 51 went down to 49¼, to rally to 51½. The Stock Exchange markets as a whole have been under the influence of industrial troubles, and the fear that these will spread into various directions. The electricity supply list gave way at one time, and, although the declines were not appreciable, the change in the character of this market, which hitherto has been so good, was indicated as a foretaste of what might happen to other markets, the shares in which were likely to be affected by labour demands.

County of London ordinary fell from 49s. 6d. to 45s. 9d., from which there was a rally to 47s. The new and old are now alike, both ordinary and preference, and probably what is happening is that the holders of the new shares are selling some of these in order to take the very handsome profit which they can secure upon the issue price of 22s.6d. Kensingtons are ½ down at 10½. Charing Cross fell 1s. to 45s. 6d. Urban preference, however, are a good market at 18s. 9d., and South Metropolitan preference improved to 25s. London Electrics are a little better at 4¼.

Metropolitan-Vickers ordinary, which have lately been up to 28s., fell to 22s., on announcement of a reduction in the dividend from 12½ per cent. to 8 per cent. It is said in the House that there was a good deal of advance selling of the shares, sufficient to arouse vague suspicion that some people had an idea of the forthcoming cut in the dividend. After the declaration, the price recovered to 24s. 9d. No change has occurred in the preference at 2 9/16.

Mention has already been made of the manner in which the electric railway stocks have been fluctuating. Metropolitans keep the steadiest of the group, showing consistent firmness, and a gain of 15s. on balance. Districts are better on the week. It may be of some academic interest to mention that anticipation looked for the strike to be settled on the basis of the 6s. advance offered to the tramwaymen. This led to an assumption that fares will have to be raised if the plight of the trams is not to become even worse than it was before the strike.

London & Suburban Traction preference regained 6d. of the recent fall, and are now 6s. a share. The ordinary stand at the rubbish price of 9d. London United Tramways ordinary command the nominal price of 3d., the preference being quoted at about a florin and the 4 per cent. debenture at 50. London General Omnibus 5 per cent. debenture has come down from 90, at which it was standing the other day, to 86, but the 4½ per cent. debenture at 89 has given way to a slight extent only.

The foreign traction group is inclined to ease off, there being declines in Anglo-Argentine Tramways first preference, Brazilian Tractions, and British Columbia Electric preferred. Mexico Tramways 5 per cent. bonds are better at 73½. British Electric Traction preference are a good market at 74. There is not much doing in this group as a whole. At the Midland Electric Corporation meeting at the end of last week, the chairman stated that a probable increase in the cost of fuel and wages faced the board. Together, these would mean a serious increase in cost, which it was hoped the company would be able to bear through increased demand and the new machinery, without raising prices to the public. Midland Counties Electric ordinary shares stand at £1 x.d., and Scottish Power ordinary at 24s., x.d. The yield on the latter is 6¼ per cent.; on Midlands, 5¼ per cent.; on Yorkshire ordinary, at 27s. 3d., the return comes to 5¼ per cent., calculating these yields on the basis of the dividends declared for 1923. There is a little doing, too, in Cawnpore Electric ordinary shares about 23s. 6d., at which the return is 8½ per cent. on the money, with dividends due in May and November.

The British Insulated & Helsby meeting produced an interesting speech from the chairman, in which he pointed out that while demand for the company's manufactures may fall off in some countries where formerly good business has been done, this is compensated to a considerable extent by other nations developing electrical power and, in their turn, becoming customers. More hands than ever before are employed at the company's factories. The price of the shares is unchanged at 2¼.

It is a long time since the cable group in our price-tables has shown no alteration at all on the week. This reflects the quietude of business in the market, where orders have fallen away in a manner which perhaps is not particularly remarkable, having regard to the labour disturbances of the times. Prices are well maintained, and Marconis are 1/16 higher at 33s. 9d. The preference rose, in sympathy, to 31s. 3d., but the debenture stock went back to 101.

General Electric at a guinea have gained a trifle. Cromptons are a better market at 11s. 3d. Siemens parted with some of their recently-acquired strength, going back to 16s. 3d. Babcock & Wilcox drooped to 45s. 9d., but the iron and steel list is not quite so dolorous as it was, better hopes of a trade revival causing timid support to come from the provinces. Rubber shares are in an apparently hopeless condition, although there remain robust optimists who look for a fairly early recovery in the produce from the present price of about 1s. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Mar. 31. 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	1⅝	— 1/16	*£5 6 8
Charing Cross Ordinary	1	14	14½	45/6	—1/-	6 7 9
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	38/9	—	6 8 0
City of London	1	15	15	49/6	—	6 1 2
do. do. 6 % Pref. ...	1	6	6	21/-	+1/-	5 0 0
County of London	1	10	15	47/-xd	—2/6	6 7 8
do. do. 6 % Pref. ...	1	6	6	1⅛xd	—	5 6 8
Edmundson's Ordinary	3	7	7	4⅛	—	5 2 7
do. 6 % Pref.	5	6	6	4⅛	—⅛	6 1 6
Kensington Ordinary	—	12	14	10½	— ½	6 13 4
London Electric	3	10	10	4⅛	—	6 7 5
do. do. 6 % Pref. ...	5	6	6	5⅛	—	5 11 7
Metropolitan	1	8½	10	1⅛	—	5 11 4
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	1	—	6 0 0
do. 5 % Pref. ...	1	5	5	16/9	—	5 19 5
do. 7 % Pref. ...	1	7	7	23/6	—	5 19 2
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	—	—	1	—	Nil.
do 6 % Pref. ...	1	5	5	18/9	+ 1/16	6 9 4
St. James' and Pall Mall ...	5	14½	17½	13⅛	—	6 13 4
South London	1	11	15	41/6	—	6 14 10
South Metropolitan Pref. ...	1	7	7	1½	+6d.	5 12 0
Westminster Ordinary	5	12	15	10⅞	—	6 19 6
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	20/6	—	7 6 4

Home Rails.

Central London Ord. Assented	Stock	4	4	68½	—	5 16 10
Metropolitan	,,	3½	4	76½	+ ¾	5 4 7
do. District	,,	3	3½	51½	+ ½	6 16 0
Underground Electric Ordinary	10	Nil	Nil	2⅞	+1/8	Nil
do. do. "A" ...	1	Nil	Nil	8/-	+3d.	Nil
do. do. Income	Bonds	5	5	96	—1	*6 5 0

Telegraphs and Telephones.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 9
do. Def.	,,	1½	34/6	29½	—	6 14 1
Chile Telephone	5	6	6	6⅛	—	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension...	10	10	10	16⅛	—	5 18 6
Eastern Tel. Ord.	Stock	10	10	169½	—	5 18 0
Globe Tel. and T. Ord.	10	10	10	17	—	5 17 8
do. do. Pref.	10	6	6	10⅝	—	5 11 7
Great Northern Tel.	10	24	22	27⅞	—	8 0 0
Indo-European	25	10	7	33½	—	*5 7 8
Marconi	1	25	15	1⅛	+ 1/16	8 17 10
Oriental Telephone Ord....	1	12	12	1½	—	*6 17 2
United R. Plate Tel.	5	8	8	6⅛	—	*5 16 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½xd	—	6 1 9

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	12½	8⅛	— 1/16	8 9 0
do. do. 2nd Pref. ...	5	Nil	6½	2½	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	73½	—1	6 16 3
British Electric Traction Ord. ...	,,	4½	5	74	+ ½	6 15 3
do. do. 6% Pref. ...	,,	6	6	90½	—	6 0 6
Brazil Traction	100	Nil	4	51½	—1½	6 15 7
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	83½	—	5 19 9
do. do. Preferred	,,	5	9/-	82½	—1	*5 16 6
do. do. Deferred	,,	8	127/-	100½	—	*6 8 9
do. do. Deb.	,,	4½	4½	76½	—	5 11 1
Lond. & Sub. Trac. 5 % Pref. ...	1	8½	5	6/-	+6d.	8 6 8
London United Tram. Deb. ...	Stock	4	4	50	—	8 0 0
Mexico Trams. 5% Bonds ...	—	Nil	Nil	73½	+1	6 16 0
do. 6% Bonds ...	—	Nil	Nil	50½	—	Nil
Mexican Light Common ...	100	Nil	Nil	23½	—	Nil
do. Pref.	100	Nil	Nil	47½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 6 0

Manufacturing Companies.

Babcock & Wilcox...	1	15	20	45/9	—6d.	*4 6 8
British Aluminium Ord.... ...	1	10	5	23/3	+9d.	4 5 10
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	48/9	—	6 3 0
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	1⅛	+ 1/16	8 17 10
Edison-Swan	4/-	10	Nil	4/9	—	6 6 4
do. ,, 5% Deb.	Stock	5	5	77½	—	6 9 0
Electric Construction	1	10	10	1⅜	—	6 7 5
English Electric	1	8	5	18/-	—	5 11 1
do. do. Pref.	1	6	6	19/-xd	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	10	5	21/-	+3d.	4 15 5
Henley	1	15	15	2 1/16	—	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 9 1
India-Rubber	1	10	17	¾	—	*6 13 4
Met.-Vickers Pref....	2	8	8	2 1/16	—	6 5 0
Siemens Ord.	1	10	10	16/3	— 1/16	Nil
Telegraph Con.	12	20	20	24	—	*5 0 0

* Dividends paid free of Income Tax

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price April 1.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	3¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net	£240	£24 dec.
Grade II ... ... ,, ,,	£172	£14 dec.
Grade III ... ... ,, ,,	£96	£6 dec.
c Brass (rolled metal 9" to 12" basis) per lb.	10½d.	...
c ,, Tubes (solid drawn) ... ,,	1/0½d. to 1/0¾d.	...
c ,, Wire, basis ... ... ,,	10¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/1¾d.	...
c ,, Bars (best selected) ... per ton	£98	£2 dec.
c ,, Sheet ... ... ,,	£98	£2 dec.
c ,, Rod ... ... ,,	£98	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£71 5s.	15/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£81 5s.	45/- dec.
d ,, ,, H.C. Wire per lb.	10¼d.	¼d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, ,, Sheet ... ... ,,	2/- to 3/6	...
a German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/6	...
h India-rubber, Para fine ... ... ,,	1/0½d.	¾d. inc.
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£35	...
g Lead, English Pig ... ... ,,	£35 15s.	5/- dec.
g Mercury ... ... per bot.	£13	£4 10s. to £2 15s. inc.
e Mica (in original cases) small ... per lb.	9d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/0½	...
p ,, ,, drawn bars & rods ,,	1/4	...
p ,, ,, rolled strip & sheet ,,	1/0½	...
p ,, ,, wire ... ... ,,	1/4½	¼d. dec.
o Platinum ... ... per oz.	£25	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton.	£258 10s.	£5 10s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/2	...

*For 1 cwt. lots. Special quotations against definite specifications.
Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
n Richard Johnson & Nephew, Ltd.
o P. Ormiston & Sons.
p Johnson, Matthey & Co., Ltd.
r C. Clifford & Son, Ltd.
W. F. Dennis & Co.

The Electrical Industry in the United States.—According to Mr. R. M. Davis, in the *American Machinist*, the year 1923 stands out as the greatest year in the history of the electric light and power industry. Not only did the industry report record output and revenue figures, but the increase over the previous year was by far the largest ever recorded. Based on operations reported for the first ten months of the year, it is estimated that a total of 66,800,000,000 kWh of electrical energy was sold by the industry during 1923, which is an increase of 26.4 per cent. over 1922, 52.0 per cent. over 1921, the year of industrial depression, and 46.2 per cent. over 1920, the peak year of post-war industrial activity. Throughout the electrical industry the year 1923 was characterised by a record volume of production in practically all classes of apparatus, exceeding in many cases the maxima of wartime output. The demand for electrical apparatus showed seasonal irregularities, but manufacture proceeded almost uniformly at a high rate. The hydro-electric projects now under actual construction under licences from the Federal Power Commission involve a proposed ultimate installation of 2,339,010 h.p., and the cost of these developments is estimated at $207,805,150. The horse-power of these projects scheduled to be put in operation in 1923 was 186,010, and in 1924, 260,780. Thirteen of the twenty-nine projects under construction are in California. It is estimated that in 1933 more than 125,000,000,000 kWh of electrical energy must be generated by the central generating plants of the country to meet the demands of customers for electrical service in the home, on the farm, and in the mine and factory. To meet this demand the central-station generator rating must be increased by 32,418,000 kVA, involving an expenditure of more than six thousand million dollars.

Brookhirst Marine Control Gear.

Some New Products.

THE extended use in recent years of Diesel engines for the propulsion of ships of comparatively large tonnage has given considerable impetus to the installation of electrically-driven auxiliary machinery in such vessels; indeed, on board most of such boats the auxiliaries are almost entirely electrical. In consequence of these developments the special design of electrical control gear for marine purposes has been given a good deal of consideration, and as a result Messrs. Brookhirst Switchgear, Ltd., have placed upon the market two new ranges of control apparatus: one for use on mercantile boats, and the other for warships; the component switchgear employed in building the two new ranges of control panels is the same as that which forms part of the familiar Brookhirst "safety-first" panels.

Marine Motor Starters.

The overall dimensions of the motor-starting panels developed for marine service have been chosen to suit confined spaces. The sheet steel case has a drip-proof hood, is weather-proof, and can be made watertight, but not submersible, if desired; small glass inspection windows are provided in the door and the switchgear itself will resist damp and corrosion, while it will operate, it is claimed, with certainty despite the rolling of the ship.

The difficulty in adapting the drum-type starter for use on ships has been the necessity for providing against the starter handle being left in the intermediate position, and the impracticability of successfully employing a spring return for this purpose led to the development of a patented slow-motion ratchet handle. This mechanism ensures that the proper sequence of starting operations must always be carried through or, if interrupted, a new start can only be commenced after the drum has been manually returned to the "off" position. "Inching," when desired, can also be obtained either by means of the operating handle or by distant push buttons. The two contactors, one in each pole, have magnetic blowouts and provide a no-voltage release; in combination with the solenoid type overload device which trips them both, they represent a true free-handle circuit breaker. The constant-speed ironclad panels are made in pillar or bulkhead (fig. 1) types, in sizes varying from 0.5 to 50 b.h.p. for pressures of from 100 to 125 volts and from 0.5 to 100 b.h.p. for from 200 to 250 volts.

The variable-speed patterns (fig. 2) are similar to those described above, both being ventilated. The shunt speed regulator is of the horizontal worm-driven type and so interlocked that the motor cannot be started with a weak field.

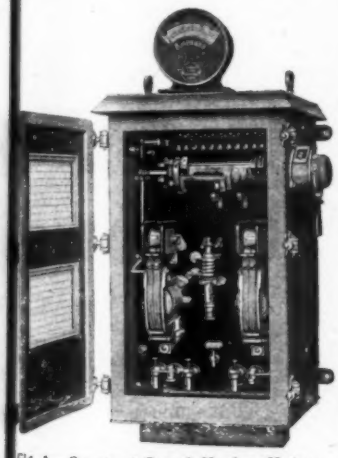

Fig. 1.—Constant-Speed Marine Motor Starter.

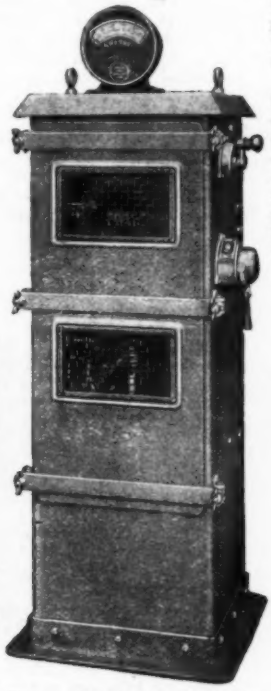

Fig. 2.—Variable-Speed Pillar Controller.

Admiralty Control Panels.

The drum-type double-pole motor starters specially designed to comply with the requirements of the Admiralty for installation on board warships (fig. 3) are suitable for all applications in which it is necessary either merely to start the motor or to start the machine and regulate its speed by means of varying resistance in the shunt field circuit. They are produced as a standard line with special regard to weight and dimensions; their operation is similar to that of the gear already described and they are mounted upon approved insulating bases, being enclosed in splash-proof steel cases with hinged doors.

Both the constant- and variable-speed types are made in three patterns, namely, varying from 0.5 to 5 b.h.p. at 110 volts and from 0.5 to 10 b.h.p. at 220 volts for motors having a normal full-load current not exceeding 40 amps. and provided with no-voltage release only; from 4 to 12 b.h.p. at 110 volts and from 8 to 25 b.h.p. at 220 volts for machines having a normal full-load current of from 40 to 60 amps. and provided with both no-voltage and overload releases as illustrated in fig. 4; from 6 to 30 b.h.p. at 110 volts, and from 13 to 60 b.h.p. at 220 volts for motors having a normal full-load current in excess of 60 amps. that are separately supplied from branch circuit breakers and fitted with no-voltage and branch breaker interlocks.

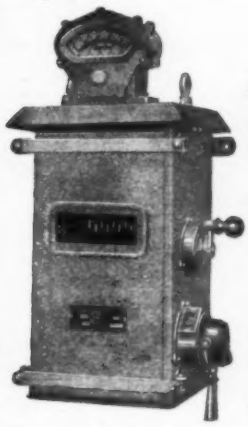

Fig. 3.—Admiralty Motor Starter.

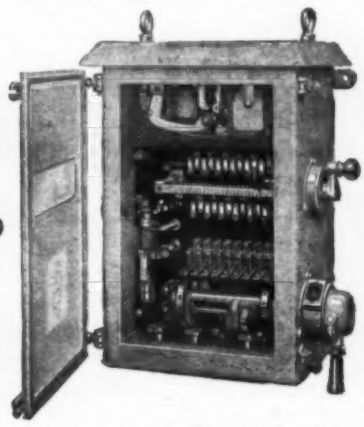

Fig. 4.—Admiralty Variable-Speed Panel.

Radio Progress in Chile.

(From Our Own Correspondent.)

NOTWITHSTANDING the fact that Chile, through its State telegraphic office, was among the first of the South American Republics to interest itself in wireless, it has proved up to the present one of the least progressive of the leading South American countries with regard to radio. While in the neighbouring Republics of Argentina (where there are approximately 30,000 sets of radio equipment) and Brazil progress upon a notable scale has been recorded, Chile has manifested no particular public interest in radio operation.

It is satisfactory to be able to state that the lack of interest hitherto noticeable is likely soon to become a thing of the past, for the development of Chilean radio gives indication of striving to keep abreast with other progressive South American States. A considerable number of native Chileans are already displaying their interest by the purchase of radio apparatus. Local amateur enthusiasts in Santiago, the capital, have intercepted messages sent out from stations in Honolulu, France, Japan, the United States and other distant places.

A local concern known as the "Chilean Radio Corporation" has established offices on the top floor of a lofty building in Santiago, wherein has been installed an amateur broadcasting station with 1 kW power. From outlying stations, within a radius of 300 miles, reports have been received that the concerts broadcast have been heard very distinctly under normal weather conditions; while, on the other hand, the Radio Corporation has received very clearly parts of musical programmes broadcast from the Avenida de Mayo station in Buenos Aires, Argentina. This, however, can occur very rarely, since the high Andean Cordillera make the reception of complete messages from Buenos Aires very difficult.

For the first time in the annals of radiotelephony in Chile, on August 20th, 1923, a conversation was held between residents in the two Republics, namely Señor A. C. Besa, of Vina-del-Mar, Chile, and the Radio Club of Tucumán. The Vina-del-Mar station was heard at 12.10 a.m., the Radio Club replying immediately, and conversation was maintained for over an hour. The transmission from Chile was heard loudly and clearly, and having regard to the low power of the transmitter, the distance of 1,000 km., and the high range of mountains intervening, this record seems to be a notable one. The S.S. *Ebro*, which was in Iquique on the night in question, clearly heard the Vina-del-Mar message, the distance being about 1,300 km.

A successful attempt was made by a Government hydroplane, flying 2,000 feet over Concón mountain, to communicate by radiotelephony with Playa Ancha and with ships of the Squadron, the apparatus having a range of 200 miles.

A smaller station maintained in Providencia (an outlying suburb of Santiago) for the past 12 or 15 months by a local

amateur radio enthusiast has succeeded in broadcasting programmes consisting of phonograph records, with an improvised equipment of 20 watts power.

While the State has not yet taken any decisive measures in regard to the national control of radio enterprise in Chile, every citizen being free to erect radio equipment transmitting undamped waves with the one reservation that no spark stations be permitted, the Government has had submitted to its consideration a project for the erection of a high-power station to be erected on the same lines as the largest station at Buenos Aires.

It is believed that during the course of the present year Chile will prove a favourable market for radio apparatus, sales being largely stimulated by the successful propaganda now being conducted by several enthusiasts who are also interested in the trade. It is pointed out that the possibilities for radio are very great in Chile, a country especially adaptable to the introduction of this system of communication owing to its lack of efficient telegraph systems and the difficulty of railway transport, occasioned by the peculiar and irregular topography of the Republic.

At present most, if not all, of the radio apparatus required is being supplied by United States and French manufacturers; but, in view of the close trade relations between Chile and the United Kingdom, there is no reason why a considerable proportion of the radio apparatus trade should not find its way to this side. To compete successfully, however, with American and French interests, which have already become firmly established, prompt shipment and closely-cut prices must be observed.

Trade Statistics of Newfoundland.

THE following figures, showing the imports into Newfoundland during 1921-22 of goods which are of interest to electrical contractors, are extracted from the recently-issued trade statistics. The figures for 1920-21 are added for purposes of comparison, and notes are given of any increases or decreases.

	1920-21. Dols.	1921-22. Dols.	Inc. or dec. Dols.
Radiators, electrical material, &c.—			
Total	181,000	71,000	– 110,000
From United Kingdom ...	20,000	1,000	– 19,000
,, Canada	47,000	12,000	– 35,000
,, United States	113,000	58,000	– 55,000
Machinery for mining purposes.—			
Total	2,000	55,000	+ 53,000
From United Kingdom ...	*	1,000	—
,, Canada	*	48,000	—
,, United States	*	5,000	—
Constructional material and machinery for pulp mills, &c.—			
Total	189,000	59,000	– 130,000
From United Kingdom ...	37,000	18,000	– 19,000
,, Canada	90,000	10,000	– 80,000
,, United States	62,000	31,000	– 31,000
Oils, lubricating.—			
Total	110,000	29,000	– 81,000
From United Kingdom ...	1,500	—	– 1,500
,, Canada	90,000	17,000	– 73,000
,, United States	18,500	12,000	– 6,500
Materials for Western Union Telegraph Co.—			
Total	16,000	19,000	+ 3,000
From United Kingdom ...	1,000	5,000	+ 4,000
,, United States	15,000	14,000	– 1,000
Goods for Anglo-American Telegraph Co.—			
Total	27,000	30,000	+ 3,000
From United Kingdom ...	21,000	4,000	– 17,000
,, United States	5,000	25,000	+ 20,000
,, Canada	1,000	500	– 500
Materials for Public Service Elec. Co.—			
Total	4,500	—	– 4,500
From Canada	500	—	– 500
,, United States	4,000	—	– 4,000
Materials for United Towns Elec. Co.—			
Total	5,500	29,000	+ 23,500
From Canada	3,000	2,000	– 1,000
,, United States	2,500	27,000	+ 24,500
Materials for Union Elec. Lt. and Power Co.—			
Total	11,000	3,000	– 8,000
From Canada	5,000	1,500	– 3,500
,, United States	6,000	1,500	– 4,500

Dollar = 4s. 2d.

* Not specified.

Electricity, the Real Domestic Help.

AT the Salesmanship Conference of the British Electrical Development Association, held at the London School of Economics on March 21st, Mr. E. Hoadley (Maidstone) read a paper on the above subject. Mr. A. G. Beaver (Sun Electrical Co.) presided.

MR. HOADLEY treated his subject from the point of view of those responsible for the working and arranging of a household, trying to discover in what ways electricity could lighten labour. Dealing first with lighting, he drew attention to the many thousands of houses which were still lighted by oil lamps, and said with regard to heating that we had not reached the stage where electricity was in general use for the warming of an entire house. This state of affairs, in his opinion, was due to two reasons, namely, expense, and the innate conservatism of the average Englishman. On the score of expense, it must be admitted that, with the rates of charge for heating generally in force, it was considerably more expensive to warm a room that was in use from 8 a.m. until 11 p.m. by electricity than by coal; but it was more desirable, and cheaper, in a large number of towns, to warm those rooms which were only wanted for a few hours a day by means of electricity than by a coal fire. If they could get the public to realise what they actually saved by the use of electricity instead of coal, he firmly believed that a lot of the talk about the expense of electric heating would vanish. He had had a case where, for some time, nothing but electricity was used for the heating of a middle-class dwelling, and the lady of the house had told him that at least 50 per cent. of the work had vanished with coal fires. From experience he was convinced that when the ways and means were brought within the range of families with little money, users of electric heating would be as plentiful as users of electric light.

The field for electric cooking was also enormous; while there remained much to be done on the part of supply authorities and makers of apparatus, yet the fundamental idea was so good that nothing could stop electricity from becoming the premier means of cooking; its very cleanliness must ensure this. Compared with other forms of cooking, electricity must win on the score of cleanliness, reliability, and the undoubted savings, which he had proved for himself really did exist. At Maidstone they had now well over 100 cookers in use, quite a number of them in workmen's dwellings; some were being supplied through slot meters, the price per kWh covering the hire of the cooker. Both the consumers and the supply authority were perfectly satisfied with the financial results. With regard to table cookery apparatus, such as chafing dishes, toasters, coffee percolators, tea infusers, &c., the results obtained from their use were practically perfect, whilst a great deal of labour was saved.

In Maidstone the electric iron was pushed "as a sprat to catch a mackerel," as, in his judgment, it was the most thoroughly satisfactory electrical device yet made. There were about 1,000 in use there. Ironing with the ordinary block of cast iron heated over the fire or gas stove was the most unsatisfactory way of doing the job that one could find. When the iron was heated on a gas ring, ironing became an expensive job, while even with a self-contained gas iron, the questions of escaping heat and the fumes could not be ignored. On the grounds of absolute reliability, perfection of working and low cost, ironing by electricity in the ordinary household stood unrivalled.

Discussing other labour-saving uses of electrical energy, in which the electric motor was made use of, he said that small motors, with the necessary attachments for doing various household jobs, had been put on the market, but the obstacles to their general adoption were that they were expensive to buy, and that, owing to the small amount of current consumed, they were not very desirable for hiring out from the point of view of the supply authority. The vacuum cleaner had suffered from the fact that it was expensive for the average householder to buy outright, and its use as a current-consuming device did not justify supply authorities in hiring it out. But when it was used regularly, the annual terrors of spring cleaning were at least made triennial, and the curtains, carpets, upholstery, &c., could be given what amounted to a spring clean every week. Neighbours might purchase a vacuum cleaner jointly, and arrange for each to use it on certain days, or wiring contractors and supply companies might let these cleaners out on temporary hire.

If engineers responsible for pushing the electrical idea would try to look at these pieces of apparatus from the point of view of the lay user, and if they framed their publicity literature with that idea in mind, he had no doubt that the use of electrical labour-saving devices would multiply many times over in the course of the next five years. He strongly advised reliability first, then cheapness, and co-operation between sellers and supply authorities.

Opening the discussion which followed, Alderman MRS. HAMMER (Hackney) said that every woman who knew anything about it wanted a vacuum cleaner, but the trouble with regard to this and some other apparatus was the price. It would never do to lend a vacuum cleaner to one's neighbour, because two people would want to use it at the same time, they would forget to oil it, and so on. Until apparatus was

produced in greater numbers, and more cheaply, municipalities, through their health and other committees, might hire them out. She emphasised the value of electric cookers, and the daintiness of everything that came out of them, and urged that they should be pushed at all costs.

Mr. C. H. Smith said that a portable electric fire would obviate the necessity of lighting a coal fire at least 75 per cent. of the days of the year. He had recently come across a very useful cabinet for drying clothes, which was being sold at a reasonable price; this should get over the difficulty of drying clothes in flats. Electric water-heating apparatus saved a great deal of labour, and could be used with great advantage in the summer months.

Mr. F. Selly (St. Marylebone) referred to a clothes-drying cabinet which he had seen at an exhibition. Its price, when heated by gas, was £16, but when electrically heated it was in the neighbourhood of £28. There was no justification for that difference in price; the whole of the electrical equipment for that cabinet could have been fitted for £2 10s. An electric kettle was useful from the point of view of the supply authorities; it would consume about 500 kWh per annum. Mr. Selly emphasised that electrical undertakings were established for the convenience of the public, and not for making huge profits.

Mr. Gamble, referring to cooking, said he had found that the greatest trouble was the hotplate; if they could get a really efficient hotplate they would sell more cookers, particularly in working men's homes.

Mr. W. A. Gillott said that if they could get the woman's point of view, it would take them a long way towards the realisation of the all-electric home. Electrical engineers and others concerned with the industry often talked of the "expense" of electric heating, but he would like to see that expression dropped; why not start a new slogan, and speak of the "economic value" of electric heating? With regard to vacuum cleaners, some years ago an undertaking with which he was connected had hired them out at 5s. per day. There was a very big demand for them, and it was found that housewives, after having hired cleaners a few times, bought them.

Mr. T. Leake gave comparative figures of the cost of lighting, heating, and cooking by electricity, and by gas and coal. In one quarter the cost for a family of five, using electricity, there being a vacuum cleaner in use, and radiators in five rooms where neither gas nor coal was used before, was £8 4s. 6d. The total cost, using gas and coal, in an equivalent quarter, was £9 0s. 8d.

Mr. Lower (Norwich) agreed that the electric iron could not be beaten as a missionary. Referring to the general satisfaction which cookers were giving in Norwich, he said he had sent round a circular letter to cooker users, asking them to give their impressions regarding the cooker. He had received replies from about 60 per cent., and about 98 per cent. of the replies expressed entire satisfaction. His experience was that cookers found the greatest favour in working and middle-class houses. As to the loading of hotplates, if the loading were increased up to reasonable limits, not only was greater satisfaction given, but the liability of breakdown was lessened. As indicating that the saturation point had not yet been reached with regard to lighting, Mr. Lower said that last year he had put on 1,200 new lighting consumers.

Mr. F. H. Howell urged the necessity for educating the public, and said it was not realised how little the public knew. Salesmanship must be followed up by service.

Mrs. Walker (North Metropolitan Electric Supply) pointed to the need for the demonstration of cookers in the home.

Mr. E. R. Morton said that he knew of many cases where people had been introduced to electrical apparatus solely through their friends and not through the salesman. The hiring of cleaners was hardly a supply authority's job, but many companies were selling them on hire-purchase terms. An electric fan would speed up the drying of clothes indoors; generally, there was not sufficient room in a flat or small house for the accommodation of a drying cabinet.

The Chairman pointed out that an important point in selling an electric iron was the fact that the person using it could sit down and work comfortably. He asked what price per kWh would make electric cooking satisfactory to both user and supplier.

Mr. Hoadley, replying to the chairman, said that the price of energy in Maidstone for heating and cooking was 1d. per kWh in the two winter quarters, and ¾d. per kWh in the two summer quarters. Where it was supplied for cooking through a slot meter the charge was 1½d. per kWh all in, including the hire of the cooker and whatever little wiring was necessary. He was paying particular attention to non-motor washing machines, in which the washing was done by spraying hot water through the clothes, the hot water spray being produced in the same way in which a coffee percolator worked. He had had good reports of the practical use of such machines. Mr. Hoadley emphasised the need for salesmen to look upon themselves as missionaries, and not to be satisfied when they had got a cooker or a number of electric fires into a household. A really efficient service was necessary. At Maidstone the staff was organised so that, if a heating element broke down it could be put right within half an hour.

Thermionic Valves.

The Dull-Emitting Filament Type.

(*Abstract of paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

This paper was submitted by the research staff of the General Electric Co., Ltd., the work described in it having been conducted by Messrs. M. Thompson and A. C. Bartlett. Following a brief statement of the theory of thermionic emission, the history of thoriated tungsten filaments is outlined and the intrinsic properties of dull-emitting valves are discussed.

The temperature at which a definite amount of electron emission will occur will be lower the more electro-positive is the substance. The problem, however, is complicated by, mainly, the physical and chemical properties of the substance. Sodium, for example, will give 14 mA of electron current per cm² of surface at about 400 deg. C., but it is easier in practice to heat a thin tungsten filament to 2,000 deg. C. than it is to maintain a small amount of sodium at 400 deg. C. Again, the vapour pressure of sodium at 400 deg. C. is so considerable that we should no longer have a hard valve; and, lastly, highly electro-positive substances are generally chemically reactive and cannot be maintained unchanged in the presence of any appreciable quantity of the residual gases, which are difficult to remove completely from an evacuated vessel.

Such considerations have so far prevented the use of any material but tungsten for the cathodes of large transmitting valves where mechanical strength is important and the removal of the last traces of residual gas almost impossible, owing to the high temperature attained by the anode. But in the smaller valves used for reception and amplification two forms of electro-positive cathode have been introduced: The first is the cathode covered with oxides of the alkaline earth metals as developed by the Western Electric Co. The second form is the thorium-coated tungsten cathode usually known as the "dull-emitting" filament because it gives the requisite emission at a temperature much lower than that of the plain tungsten filament, although it is higher than that at which oxide-coated filaments are run; consequently by "dull emitter" is meant, not any valve with a cathode at a relatively low temperature, but only the thorium-coated tungsten filament.

One of the first problems undertaken by the Research Laboratories of the General Electric Co. was that of investigating the electrical behaviour of thoriated-tungsten filaments. In addition to an extremely high degree of vacuum, it was essential that all surfaces which collected electrons should be free from adsorbed layers of gas. It was comparatively easy by electron bombardment to free the anode from all traces of gas, but much more difficult to do so with the grid. Heating the grid by the passage of current through it was ruled out because a spiral grid with no damping wire causes microphonic noises in the receiving set. It proved possible, however, to cover the surface of the grid with a gas-free deposit or varnish, after which deposition electron current could be passed from filament to grid for long periods (the grid potential being 50 volts or more) without liberating harmful gas from the surface of the grid, despite the fact that the grid metal certainly contained occluded gases.

If the anodes were freed from gas by electron bombardment, a lower limit would be set to the filament diameter and current, since filament wastage always occurs during the process. Induction heating by radio-frequency currents was tried with success for the Royal Air Force, a valve oscillator being used for the generation of the high-frequency current. By this method, receiving valves were produced in 1920, the filaments of which required only 0.07 ampere at 1.8 volts, and also other valves having a lower anode impedance, in which the filaments consumed 0.1 ampere at 3 volts. Both types were not satisfactory, chiefly on account of the margin of tension between that which would break the filament and that necessary to keep the filament off the grid being exceedingly small.

The possibility of using the thinnest filament of lamp manufacture has recently been demonstrated by the General Electric Co. of America, which used no filament tension at all, but arranged the dimensions of filament length and grid diameter so that the filament on being heated did not expand sufficiently to cause it to sag on to the grid. This

American valve takes 0.06 ampere at 3 volts and is truly within the capacity of dry cells. A similar type of valve is also made by several manufacturers in this country.

When carrying out the first experiments on thorium emission in a complete triode, a valve of a standard type was used. Thorium emission having been stabilised, there appeared to be a considerable reduction in the grid current at zero grid voltage, and anode and grid current characteristic curves showed that both curves were shifted bodily to the right, when compared with a similar valve containing an ordinary tungsten filament. The amount of shift was equivalent to about 1.5 volts on the grid. Characteristic curves before and after the formation of the thorium surface layer

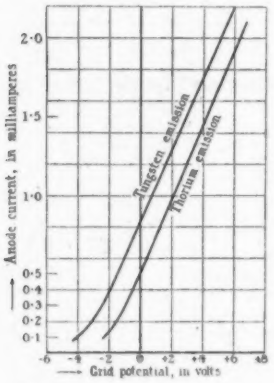

Fig. 1.—Anode-current/Grid-voltage Characteristics.

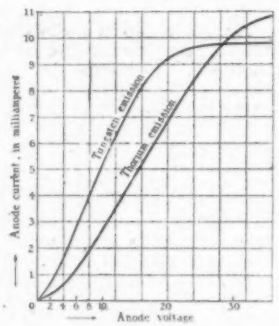

Fig. 2.—Anode-current/Anode-voltage Characteristics.

with the same total emission (9.6 mA) showed that it was possible to demonstrate this particular effect with the same filament in the same valve (fig. 1).

In addition, the anode-current/anode-voltage characteristic was also less steep with the dull-emitting filament, while in diodes the saturation part of the curve was less flat than it is for tungsten emission, fig. 2. This lack of sharp saturation was ascribed by Langmuir to a kind of grid effect at the heterogeneous filament surface which is not completely covered with thorium, the tungsten part of the surface acting in the same way as a negatively charged grid.

Re-design of the electrodes to obtain a slightly narrower grid of rather closer pitch was required to obtain approximately the same characteristic at the same operating voltages on grid and anode.

Stability of thorium emission is of fundamental importance and depends upon: (i) filament temperature. After enhancing electron emission by heat treatment at 2,900 deg. K. for about a minute, followed by 2,250 deg. K. for several minutes, the emission becomes steady over very long periods, during which the filament remains at a temperature of from 1,700 to 1,800 deg. K. If, however, its temperature were raised above 2,250 deg. K. the emission would rapidly decrease to that of pure tungsten, but lowering the temperature to 2,250 deg. K. again would restore the enhanced emission. Such changes are due to evaporation of thorium from the filament surface at the higher temperatures, and diffusion from the interior of more thorium at the lower temperature is easy to understand. It is not so easy, however, to visualise what happens during the original treatment at 2,900 deg. K. which was found necessary in order to produce the emission, unless the actual formation of elementary thorium from its oxide occurs at this temperature. After being incandesced for an hour at 2,900/3,000 deg. K. no oxide remained in a filament 0.06 mm in diameter, but there was still present an amount of thorium of the same order of magnitude as that which would be equivalent to the original oxide.

Life tests have shown that, with filament temperatures not exceeding about 1,900 deg. K., practically constant electron emission is obtained during periods which are very seldom less than, and generally in excess of, 1,000 hours; in general the emission life is longer the lower the temperature of the filament. At operating temperatures of 1,700/1,900 deg. K. early results showed some diffusion of thorium to the surface, although much more slowly than at 2,250 deg. K., and Langmuir has recently found that thorium atoms evaporate from underlying thorium atoms at a rate very high compared with that of thorium from underlying tungsten atoms.

(ii) Anode voltage, an increase of which decreases the thorium emission life of a valve, other factors being constant; also it was found that the maximum anode voltage which would allow of a satisfactory life was a function of the size and shape of the enclosing bulb, the permissible voltage increasing with increasing bulb diameter.

This dependence upon bulb diameter seemed to indicate that stray electrons which followed circuitous paths to the anode were causing ionization of some of the gas molecules which are always adsorbed on the surface of the bulb, the resulting positive ions then travelling to the filament, where they slowly but surely contaminated the thorium surface.

(iii) The degree of vacuum, probably the most important factor from the manufacturing point of view. To obtain stable emission during a life of approximately 1,000 hours the pressure of residual gas had to be not more than about 0.00001 mm (of mercury).

A percentage of the products of the Marconi-Osram works is collected two or three times a week and tested at the laboratories.* Typical curves obtained in this way for the D.E.V. valve, of which the filament takes 0.2 ampere at 3 volts, are shown in fig. 3, the filament voltage in each case being that required to give a constant emission of 5 mA.

Crackling and microphonic noise only become important in receiving circuits in which more than two stages of audio-frequency amplification are employed.

The cause or cure of crackling has not proved easy to discover, although the phenomenon is generally looked upon as being due to impurities in the filament and its magnitude can be reduced to some extent by heat treatment of the filament.

Dull-emitting filaments are, however, almost entirely free from this first defect, but are offenders in respect of the second, which is entirely due to the filament retaining a high degree of elasticity at its normal operating temperature. At present the only practicable method of eliminating these noises seems to be to mount the valve on a holder designed to prevent any except very low-frequency vibrations from reaching the valve. These noises are due simply to transverse vibration of the filament, although there is a certain amount of evidence that the rate of damping of the vibration is influenced slightly by the kind of supports used.

In order to eliminate the noises entirely, the only practicable way seems to be to prevent any vibration from reaching the filament from outside. A design of valve holder which achieves this object depends upon the fact that a spiral spring can be made which has a very low natural periodicity for transverse, longitudinal, and torsional vibration. The valve holder is supported on such a spring and connections are made to terminal points on the base by means of phosphor-bronze springs. There is no necessity, of course, to use this type of holder when only two stages of audio-frequency amplification are used.

The customary operating power for the oxide-coated filament is from 8 to 9 watts per cm² of cathode surface, and the range of efficiencies lies between 10 mA of electron emission per watt (of heating power) and 100 mA per watt. The thoriated filament efficiency ranges from 10 mA per watt at 1,630° K. to 200 mA per watt at 1,910° K., and 400 mA per watt at 2,005° K.

These figures, however, neglect the loss of power in the leads, and the apparent difference between the two filaments is in practice reduced as a result of the increased loss due

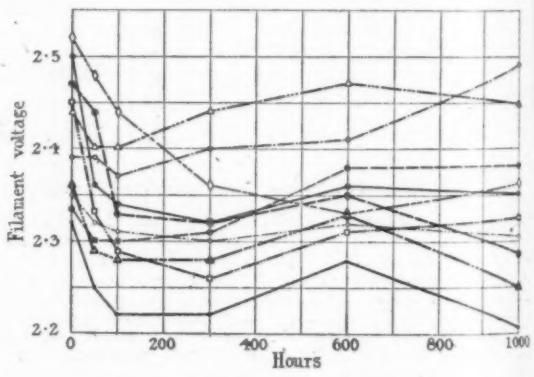

Fig. 3.—Life Test of D.E.V. Valves.

to the heat conducted away by the filament leads in the case of the thoriated filaments, which operate at a temperature from 500 to 600 deg. higher than the oxide-coated ones. Actual valves of the two types, produced commercially, show practically no difference between the efficiencies of the two filaments, and the results of any rivalry between the two will probably be determined by other factors.

Manchester Steam Users' Association.—The annual report for 1923 of the Committee of Management states that the membership is now 1,854, and the number of boilers under inspection 11,678. During the year 25,678 inspections were made, and it is noted that in the whole of the Association's existence (nearly 70 years) no *preventable* explosion has occurred in any boiler which has carried the Association's guarantee and certificate of safety. Tests on two old boilers have established the fact that wrought-iron steam boilers do no appreciably deteriorate with age. The sanction of members to the inauguration of a staff pension fund is to be sought at the annual meeting of the Association.

* The methods of life-testing valves will be described in a later paper.

The Future of Main-Line Electrification on British Railways.

By Lieut.-Col. H. E. O'BRIEN, D.S.O.

(*Abstract of a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THIS paper commences with an apology from the author for again dealing with a subject upon which so much has been written recently. The matter is so important, however, that he thinks it desirable to reiterate the arguments in favour of electrification of main lines in a form which will appeal to both railway and electrical engineers.

The disabilities under which the steam locomotive labours are briefly summarised, and, after dismissing in a few words the subject of turbo-electric and internal-combustion locomotives, the merits of the electric locomotive are set out. These are, briefly:—Capacity for almost continuous service in traffic; low cost of repairs; high tractive capacity; low weight per available h.p.; reliability; independence of weather conditions; even turning effort; high mechanical efficiency and wide range of maximum efficiency; possibility of operation as a unit or in combination by one man; elimination of movements performed by the steam locomotive in coaling and watering; greater flexibility of wheel base; and the ability to meet large instantaneous overloads. The disadvantages are the number of units which may be held up by a failure of energy supply, and the dependence of each unit upon contact with the supply system. On a mixed steam and electricity system there is the disadvantage of changing over at terminal points.

For purposes of comparison the author takes the average cost of all steam services per engine mile, the average cost of a high-speed electric passenger service (suburban), and the estimated cost of operating the latter service by steam. The total cost in the first case is given as 26.678d. per steam-engine mile; in the second case as 26.17d. per train mile; and in the third case as 33.00d. per engine mile. It is therefore evident that, given a certain density of traffic, the cost of electrical operation of suburban trains is markedly lower than the average cost of steam operation. This has been confirmed by figures presented by Sir Philip Dawson.

The author then proceeds to compare the two types in respect of main-line working. The steam stock consists of four typical freight and four passenger locomotives, and eight corresponding electric locomotives. From a table which is given it can be seen that for the same weight there is rather more than a 60 per cent. increase in the continuous draw-bar horse-power. This has an important bearing on the cost of accelerating present services. Tests made on 500-ton passenger and 640-ton freight trains hauled by steam locomotives run at average speeds over a line with heavy gradients, well in excess of the average booked schedule speeds and yet without increase of maximum speed, showed that as soon as the maximum draw-bar h.p. required exceeded that obtainable from one locomotive, the ratio of both maximum and mean draw-bar effort to adhesive weight became very large. The weight of the locomotives was nearly 50 per cent. of the weight of the train in the case of the passenger train, and 37 per cent. in that of the freight train. As the maximum draw-bar pull did not exceed from 8 to 9 tons for the mean speed, an electric locomotive of a total weight of 116 tons and 72 adhesive tons available for traction would have met all requirements.

Faster speeds on up gradients can be obtained by the steam locomotive only at the expense of heavy fuel consumption and exceptional wear and tear; with an electric locomotive much better results can be obtained. The author presents an example to prove this, showing that a 750-ton train can be hauled up a .75 per cent. gradient, 30 miles in length, by an electric locomotive in half the time taken by a steam locomotive, with an expenditure of only 27.8 per cent. more energy. The train could only be dealt with by a combination of three steam locomotives with a crew of six men, and weighing 348 tons; an electric locomotive weighing 116 tons and operated by a single man could perform the same duty with ease. On the return journey the electric locomotive would be equally efficient when working at the rate of 3,000 h.p., its one-hour rating, or at 750 h.p. if required to work a lighter train back, while the steam locomotives would be at a grave disadvantage in this respect. Other examples are quoted to show how services can be speeded up by the substitution of electric for steam locomotives.

The result of experience on suburban lines of the London and North-Eastern Railway in this country and numerous electrified railways elsewhere, shows that the cost of repairs to an electric locomotive is from one-third to one-quarter of that of a steam locomotive per engine-mile, and the same reduction in cost occurs in connection with subsidiary services rendered at steam sheds, such as cleaning, coaling, washing-out boilers, &c. Owing to the simplicity and excellence of construction of the electric locomotive it is probable that the average mileage obtainable between general repairs to the electrical equipment will exceed 200,000 miles. The facts that the London and South-Western Railway on its suburban equipments and the London and North-Eastern on its freight locomotives have never rewound an armature or field coil during seven years' operation, and that the life of the modern commutator is at least 750,000 miles, are strong indications that the forecast given of the cost of repairs is correct. The turning and changing of tires and axle brasses, the renewal of brake blocks, and the repairs to auxiliaries such as vacuum pumps, will be the principal causes of an interruption to continuity of service for any appreciable period. As neither these nor motor repairs will necessitate the return of the locomotive to the main repair shops, the capacity of these for steam-locomotive repairs will be considerably increased

The electric locomotive is capable of an annual mileage of from 40,000 to 50,000 miles per annum, as compared with an average of about 20,000 miles for a steam locomotive; in fact, the mileage possibilities are only limited by the traffic requirements and the extent to which engine workings can be arranged to permit of continuous service. Universal experience indicates that one electric locomotive will at least perform the duty of two steam locomotives. The reliability of the electrical supply equipment is so great to-day that the most modern suburban electrifications never suffer more than momentary interruptions due to circuit breakers operating. The total cost of enginemen's wages is also substantially reduced.

A table is given in the paper showing the comparative costs of superintendence, enginemen's wages, repairs, water, lubricants, other stores and clothing, miscellaneous, and wages at sheds. From this it is seen that the total per engine-mile is 18.836d. for the steam locomotive and 8.900d. for the electric locomotive. It is pointed out, however, that this difference is somewhat lessened by the average density of traffic, which seriously affects the cost of energy supplied to the electric locomotive.

The author makes a comparison between the costs of fuel and current. The following bases are taken:—Generation, three-phase at 11,000 volts; overhead three-phase transmission at 44,000 to 66,000 volts according to distance; conversion by mercury arc rectifier to 1,500 volts (d.c.), and distribution at this voltage by third rail, with overhead equipment in stations and station yards. The cost of coal for locomotive purposes has been assumed to be 23s. per ton delivered to the locomotive depôt in wagons, equivalent to 7.40d. per engine-mile at 60 lb. of coal per mile, and the cost of high-pressure current at the 44,000-volt busbars at the power station to be 0.40d. per kWh.

In comparing the costs of generation at typical power stations with load-factors of between 25 and 30 per cent. with the probable cost of energy from a main-line station with a load factor of 50 per cent., the author shows that the average cost at the first stations is 0.46d. per kWh, while in the other case it is reduced to 0.38d. per kWh. Between these two is the suburban-line power station with a load factor of 40 per cent. and a generating cost of 0.395d. per kWh. The figures include the cost of coal, oil, waste, repairs, salaries and wages, and interest and depreciation at 8 per cent. The author takes the figure as 0.40d. per h.p. kWh generated, and shows that this cost is increased on the score of efficiency alone to 0.60d. per kWh equivalent at the tread of the wheels. To this must be added the further costs of operation, maintenance, interest and depreciation of the h.p. and l.p. transmission systems, and the converting plant. The figure of 26.8 watt-hours per ton-mile for steam traffic is taken as a basis of comparison.

Another table (I) has been prepared to show the application of current cost to the whole cost of locomotive operation, and the consequent reduction which may be expected in the total cost of locomotive operation per engine-mile in relation to the density of traffic.

TABLE I.—*Reduction in Operating Cost per Engine-mile, due to Electrification, for Various Traffic Densities.*

Traffic density: trailing ton-miles per track-mile.	Total cost of electric locomotive operation per engine-mile.	Cost of steam locomotive operation per engine-mile.	Economy per engine-mile.
Ton-miles.	d.	d.	d.
2,000,000	27·5	26·24	1·26 loss
3,000,000	23·7	26·24	2·54
4,000,000	21·5	26·24	4·74
5,000,000	20·5	26·24	5·74
6,000,000	19·75	26·24	6·49
7,000,000	19·22	26·24	7·02
8,000,000	18·85	26·24	7·39

The figures have been taken on a very conservative basis so that it may be assumed that, even discounting to some extent the reduction in operating costs, main-line electrification is worth carrying out at a density of 3,000,000 or more trailing ton-miles per track-mile per annum. A study of traffic densities on some of the former principal systems proves that, taken as a whole, most of the systems fall within the category of possible successful main-line electrifications. As each of these large systems includes many branch lines with very sparse traffic, which could not be profitably electrified, it follows that the main traffic routes must have much higher traffic densities, and that electrification on the score of reduced costs for locomotive maintenance and operation alone will be remunerative. Figures given in the paper indicate that main-line electrification is a probable source of largely increased revenue, and that a thorough investigation of the possibilities of electrification in connection with the main arteries of railway traffic is very desirable.

Such an electrification covering possibly 500 miles of route would not be supplied by a single generating station, but would probably be supplied from at least six, and probably from eight, generating stations. The use of cables would raise the price of current to a prohibitive figure, and therefore overhead transmission is practically compulsory.

The track equipment will in the main be on the third-rail system, but considerations of continuity of contact at junctions, particularly with reference to freight locomotive operation, will necessitate short lengths of overhead distribution, thus involving the provision of both collector shoes and bows on the locomotives. As the overhead collector must be clear above the structure gauge, the bow in its "up" position fouls the structure gauge, and means will therefore have to be provided whereby the bow automatically rises to meet any stretch of overhead trolley and automatically falls when it leaves it, or, alternatively, every overbridge and tunnel will have to be equipped with a dummy trolley. Unless means are provided for making the bow dead when the third-rail shoes are alive, these dummy sections will have to be insulated for the full line pressure.

It has not yet been possible to determine whether sidings would be more economically dealt with by electrification with overhead conductors or by operation with storage-battery locomotives. Probably both methods would be adopted.

The provision of electric locomotives capable of the maximum utilisation of traffic, which is of the utmost importance in view of their capacity for continuous traffic, is perhaps the most difficult problem of all. Its solution is, however, facilitated by the approximation of the speed of freight and passenger trains made possible by electric traction.

The speed of freight trains is in general limited by (1) the brake power available, and (2) the efficiency of axle-box lubrication. With regard to the latter, the existence of a very large number of grease-lubricated axle boxes is the limiting feature. Maximum speeds of 45 m.p.h. are, however, usual even with these grease boxes, and the average speed can obviously be raised very considerably. The electric locomotive can be braked in new designs to a greater extent than the average of the steam freight locomotives now in use. The utilisation of field control also permits of a very wide range of speed with a comparatively small percentage of weight variation in the motors.

To improve brake control on routes with heavy gradients, electrification makes it possible to equip a certain number of freight brake-vans with collecting shoes, vacuum reservoir, and vacuum pump and vacuum brake gear, thus giving, in case of a break-loose on a rising grade, the goods guard a control over the train much superior to that possible under steam conditions.

The problem of dealing with train-heating is not easy, but the electrically-heated boiler used by Sir Vincent Raven on his electric express passenger locomotive will probably have to be used in the initial stages. As electrification progresses trains which circulate exclusively in the electrified area will be fitted with electric heaters, but the present system of lighting will continue. Incidentally, the substitution of electric heaters for the present steam system will eventually effect a substantial economy as compared with the present steam-heating system.

Most difficult of all of solution is the problem of making the main-line express or freight locomotive perfectly safe to operate with one man. This will be a matter for future consideration, and, obviously, at the outset of the electrification locomotives handling heavy trains or trains running long distances without a stop will be operated by two men as at present.

There are five appendices to the paper, the first of which deals with the reduction in the number of locomotives by the substitution of electric traction and reduced cost of repairs, largely based on American experience. Appendix 2 gives approximate figures of the cost of the replacement of steam locomotives by electric locomotives. The third appendix sets out figures relating to traffic density on one of the former large independent railway systems which carried the heaviest traffic, and one of the suburban electrifications. Appendix 4 contains various data relating to the coal consumption and the efficiency of locomotives, while the last appendix is an estimate of the reduction in coal consumption to be effected by electric traction on all railways in Great Britain. The author arrives at the conclusion that the coal saved by this means would be 2.4 per cent. of the coal raised.

Discussion.

Mr. Roger T. Smith, in opening the discussion in London on March 27th, said that the author claimed that the density of traffic was greater on main lines than on suburban lines, using the engine-mile as a unit. He did not think that this was the most convenient unit as it took no account of weight, speed, or the number of stops. Ton-miles per engine-hour would be a much more satisfactory unit and more uniform results would be obtained. The author used the traffic density as a criterion of the desirability of electrifying a line, but he omitted to mention the great advantages of the speed characteristics of the electric locomotive; the uniformity of speed in passenger and freight traffic had been a decisive factor in Italian railway electrification. Referring to the backwardness of this country in the matter of main line electrification, Mr. Smith said that the traffic superintendents should be converted to the idea and the rest would follow.

Dr. Lydall said that the loads hauled in this country were too small; in the United States, loads of from 2,000 to 5,000 tons were common. One of the disadvantages of electrification was said to be the danger of the holding up of the whole system by a failure of supply. What weight was to be attached to this? The Tyneside lines, supplied from the Newcastle Supply Co.'s station, were only affected by an average of one breakdown in two years during the period 1905-1920, and this of merely a few minutes' duration. The record of the Newport-Shildon line was better still. On a modern power system the danger of interruption was negligible. Referring to the tractive-resistance curves given by the author, Dr. Lydall said that the varying tractive resistance affected the energy consumption, and was of great importance. In conclusion the speaker gave figures of comparison between electric and steam locomotives in the United States, Switzerland, &c., and said that, if traffic offered, the electric locomotive could run 100,000 miles per annum.

Mr. F. W. Carter remarked that the author had given the cost of energy based upon 3-phase generation, overhead transmission, mercury arc rectification, and third rail supply. The use of overhead transmission and the third rail was a matter of opinion. Was the cost of energy based on an actual station; and if so what was the price of coal? The efficiency of conversion was probably higher than was usually taken into account; he was inclined to think that the overall efficiency was more like 90 per cent. than 85 per cent.

Mr. J. S. Highfield agreed with Mr. Smith that it was necessary to win over the traffic superintendent. A mere statement of costs was not sufficient to convert him, and indeed, when interest charges were balanced against savings there was not much in it. The saving of coal was important, and this, together with the development of water power, had stimulated the electrification of the French main lines.

Sir Philip Dawson, in a statement which was read by Mr. A. E. Jackson, regretted that the figures given by the author were only of a general nature and not based on a concrete case. The author, too, had tied himself mainly to one system of electrification, but it was considered by experts that much higher line pressures than those mentioned in the paper would have to be used if main-line electrification was to be applied in a general way. The introduction of the transverter might lead to the favouring of high-pressure a.c. traction. The grouping of the British railways had shelved a number of contemplated schemes, including the electrification of suburban lines into Liverpool Street, the main line from York to Newcastle, the main line to Brighton, Worthing and Eastbourne, and the Glasgow district lines. So far as the Brighton section was concerned investigations had shown that the seat miles could be increased by 140 per cent. on the suburban lines and 70 per cent. on the main lines. The total capital expenditure involved was £11,000,000, and on assumptions unfavourable to electricity a saving of £626,000 could have been effected, or a maximum of £1,608,000. The net receipts could have been increased possibly by £2,212,600. It was proved conclusively that by far the best-paying portion of the whole of the proposals was the electrification of the main line to Brighton.

Mr. Richards thought that one or two assumptions in the paper were rather too unfavourable to electricity—in the matter of superintendence, for instance, where there would be a great saving. The saving of 6,000,000 tons of coal per annum was of great national importance.

Mr. R. Brooks said that nothing had been said with regard to standardisation, but there were dangers in too-early standardisation. The aim should be the simplification of equipment; energy should be devoted to obtaining the minimum of parts and complexity. Excessive caution was unnecessary; railway authorities could now go forward in the full belief that the success which had attended main-line electrification elsewhere could reasonably be expected in this country.

Lt.-Col. O'Brien, in the course of his reply, said that the savings alone would justify conversion. The representatives of power companies present had not challenged his figures. It was important to remember that many lines were at the limit of their capacity with steam traction. He reserved his full reply for publication in the Institution *Journal*.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Clifton" Lighting System for Mines.

The "Clifton" continuity mine-lighting system developed by the Central Electrical Co., 3, Low Pavement, Nottingham, obviates the cutting of armour wires and cores. The connector box, shown in fig. 1, is of soft grey iron, in two parts, the ends of which are drilled to encircle cable of any dimensions. At the cable entrance is an annular groove for any sealing material which may be used when the box is not filled with compound. There is a pair of armour clips bolted to the box to ensure efficient earthing. The insulators are moulded in high-grade fireproof material, and the connectors are of turned brass, with the bottom half moulded

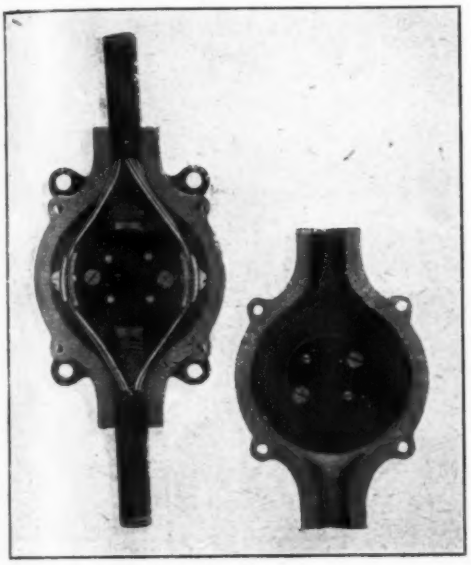

Fig. 1.—The "Clifton" Lighting Connector Box.

into the insulators. The top half is arranged to take plugs, and the connections are secured by a universal key. Lampholders, switches, and fuses are directly coupled to the connection by continuous plugs. All preparation and connection of cables can be made before fitting them into the box. The braiding of the cable is stripped over a length equal to the interior length of the box, and is lightly bound at the cuts. The cable is then twisted to "birdcage" the armour wires, which are separated in two bunches and secured by the clips. The cores are bared sufficiently to enable them to be clamped by the connectors, which are fitted, and the whole put into the box. It is claimed that the box is smaller, lighter, and lower than those of other systems; that it is explosion, water, and acid proof; and that the cable can be prepared for the fittings in five minutes.

A New Anti-Dazzle Lamp Bulb.

Messrs. C. A. Vandervell & Co., Ltd., of Acton, London, W.3, have placed upon the market a new electric lamp bulb for use on motor cars and similar vehicles which is claimed to possess anti-dazzle properties. As will be seen from fig.

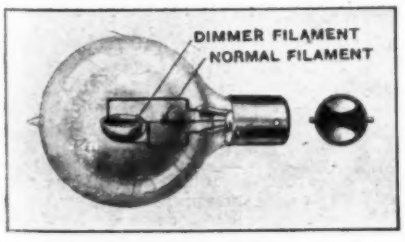

Fig. 2.—New Anti-Dazzle Lamp.

2, it is provided with two filaments, the back one being in focus, while the forward one is shaded by a little semi-circular metal cup. When the back filament is in use the headlamp will give its full normal driving light, throwing a beam down the road and also illuminating the road sides. When approaching oncoming traffic, however, the simple movement of a switch brings the forward filament into use, and cuts out the back one, the metal cup shielding all rays from the bottom of the reflector so that there are no upward rays to blind the approaching driver; at the same time, as a result of the light being thrown on to the top of the reflector, the downward illumination on the road immediately in front of the car is increased. It is also claimed that the new lamp has great advantages when driving in fog. The bulbs, Grave's patent, can be fitted to any make of headlamp; all that is necessary is the careful focusing of the bulbs and the alteration of the wiring, for which purpose a diagram is supplied. The bulbs are supplied for 6 or 12 volts, complete with a change-over switch and a set of cables.

The "Lydall" Automatic Centrifugal Clutch.

Fig. 3 illustrates the automatic centrifugal clutch referred to in our "Correspondence" columns to-day. The principle of this, the "Lydall" clutch, consists in the adoption of two ratchet wheels arranged oppositely with a washer of friction material between them. In the case of small clutches the shoes are fitted with spring pawls which engage the two ratchets, and as the clutch speed increases, the centrifugal force of the shoes tends to revolve the ratchet wheels in opposite directions; this movement is controlled by tightening the wing or knurled nut, adjustment of which allows the ratchets to release the shoes when desired only. This can be done from rest to full speed. In large clutches the ratchets are arranged inside the shoe and the spring pawls are attached to the spider, the adjusting wing or knurled nuts passing through the cover to the outside.

Fig. 3.—The "Lydall" Automatic Centrifugal Clutch.

The clutches are made by Centrifugal Clutches, Ltd., 32, John William Street, Huddersfield.

The "Gecophone" Low-frequency Transformer.

Many of the troubles experienced by amateurs in the construction and manipulation of their sets are due to unsatisfactory or unsuitable low-frequency transformers. The design of

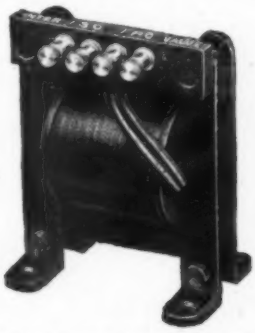

Fig. 4.—The "Gecophone" Low-Frequency Transformer.

a transformer involves something more than merely winding so many turns of wire on a bobbin. Such matters as good insulation, the correct proportioning of the iron circuit, and the selection of suitable material for the core should receive

careful consideration. The "Gecophone" low-frequency transformer illustrated in fig. 4 is made by the General Electric Co., Ltd., at its Salford electrical instrument works, in Manchester, and is the product of long experience and excellent manufacturing facilities for this class of work. The windings are all of silk-covered wire, carefully wound and properly insulated so that "shorted" turns are impossible. The very greatest care is taken in designing the iron circuit, the best laminated Stalloy being used for this purpose. The sections are amply proportioned for the work required so that any increase in current produces a corresponding increase in magnetic flux. The design is such that the transformer is not affected by stray magnetic influence.

Each transformer is carefully tested after manufacture on alternating currents of ordinary speech frequencies, and, moreover, measurements of the inductance and self capacity of the winding are taken after manufacture. The whole design is similar to that used by the G.P.O. for speech transformation on telephone circuits.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Southern Railway Electrification.—On March 24th, Sir Kingsley Wood asked the Minister of Transport whether the electrification of the Southern Railway was proceeding; when the laying of the conductor rails in the Woolwich area would be proceeded with; and whether work would be provided for local labour.

Mr. Gosling said that he was informed by the company that the electrification of the suburban lines of the South-Eastern section of the Southern Railway was proceeding with all possible speed, and that 68 miles of conductor rail had already been fixed. The laying of the rails on the North Kent line would be commenced in about two months time. The company also stated that local labour had been engaged in connection with the work.

A Thames Tunnel.—On March 24th, Sir Kingsley Wood asked the Minister of Transport whether he had considered the proposal for a tunnel under the Thames from the north to the south side of Woolwich; and if he proposed to take any action in the matter.

Mr. Gosling replied that although his attention had been called by the Woolwich Employment Committee to the desirability of a tunnel at that point, no scheme had been submitted for its construction. Should any such scheme be prepared it would receive full consideration.

Tramway Finance.—On March 24th, Mr. H. Morrison asked the Prime Minister whether he was aware that the London County Council tramways for the current financial year bore burdens approximately as follows:—Maintenance of track £250,000, rates on track £67,000, loan charges on street widenings £29,000, and that these charges were £94,000 more than the total cost to the undertaking of meeting in full the demands of the Transport and General Workers' Union in respect of the London County Council tramway employés; and whether, for reasons of equity and with a view to assisting the London tramway undertakings, the Government would so far as was necessary introduce legislation relieving the undertakings of these charges coupled with any provisions regarded as expedient to meet the financial objections of the highway authorities.

Mr. Gosling, who replied, said that he would consider carefully proposals by responsible authorities, but he feared that such a large general question could not be dealt with by emergency legislation.

Coal Exports.—On March 25th, Mr. Shinwell, Secretary for Mines, informed Mr. Batey that one hundred million tons of coal were shipped abroad from Great Britain in 1923, as cargo or bunkers, and 177 million tons were available for inland consumption. Of the latter it might be estimated that about 41 million tons were domestic coal and about 136 million tons were for industrial or other purposes. The average value of the coal exported as cargo was 25s. 2d. a ton f.o.b., and the average pithead price of all coal disposed of commercially (including exports) was 19s. 9½d. a ton.

The Menai Bridge.—On March 25th, Lord Huntingfield asked the Minister of Transport, if, in reconstructing the Menai Bridge, he would consider building a barrage across the Menai Straits in order to produce hydro-electricity from the tidal race.

Mr. Gosling said that any such project would require lengthy investigation and affect several Departments besides the Ministry of Transport, but if a well-considered scheme was put forward by responsible bodies he would see that it was carefully examined.

Home Materials.—On March 25th, in answer to Mr. T. Thomson, Mr. Clynes, Lord Privy Seal, said that the Government had decided that the Unemployment Grants Committee should adhere to its existing practice of insisting on the use of home materials in schemes assisted by it for the relief of unemployment, subject to the exercise of its discretion in abnormal circumstances.

The Marconi Company.—On March 26th, Mr. Ludley asked the Postmaster-General if he proposed to expropriate the patents of the Marconi Wireless Telegraph Company for the use of the Post Office; and if he proposed to levy a royalty on the company's existing business.

Mr. V. Hartshorn said that the answer to the first part of the question was in the negative. The terms on which patents might be used in the service of the Crown were laid down in Section 8 of the Patents and Designs Act, 1919. As regarded the second part of the question, the Imperial Wireless Telegraphy Committee recommended that in the case of any Anglo-Continental wireless services established by private enterprise, suitable terms should be arranged for the payment of royalties or otherwise in view of the competition between such services and the State-owned cable. The report was still under the consideration of the Government.

Relief Works.—On March 26th, Mr. Masterman asked the Minister of Labour whether he could provide the figures of the amounts actually spent during the last winter in providing employment for the unemployed of the 50 millions provided last autumn in cash or credit by the late Government.

Mr. Shaw said the £50,000,000 was made up of:—£14,000,000, road and bridge programme; £10,000,000, extension of Unemployment Grants Committee schemes:—£12,000,000, Trade Facilities Guarantees; £10,000,000 to £15,000,000, railway companies' expenditure. He added that the Ministry of Transport had been authorised to impress on local authorities the importance of proceeding with certain electricity schemes.

Unemployment Grants Committee.—On March 26th, in the House of Lords, Lord St. Davids, speaking as chairman of the Unemployment Grants Committee, said that the Committee had had 12,260 schemes submitted to it, and of these it had approved 8,352, amounting to £61,600,000 up to the end of February. It had been decided that no materials except British were to be used, but all through its work the Committee had had the greatest difficulty in insisting that such articles as tramway rails should be brought from British makers and not from abroad.

Clyde Valley Electrical Power Bill.—This Bill was read a second time in the House of Lords on March 26th.

Legal.

H. H. Oxley Sentenced.

Before the Recorder (Sir Ernest Wild, K.C.), at the Central Criminal Court, on March 28th, Henry Hallifield Oxley, 40, electrical engineer, surrendered to his bail and pleaded guilty to an indictment which charged him with fraudulent conversion, false pretences, and obtaining credit without disclosing that he was an undischarged bankrupt.

Mr. Percival Clarke, who appeared for the prosecution, said that the false pretences charge related to a Mr. Henry Merrin, who was the London manager of Messrs. Matthews and Yates, engineers, of Swinton, Manchester, and was in connection with a scheme which the defendant proposed for the conversion of a house in Lancaster Gate into flats. The fraudulent conversion charges were in respect of transactions with a Mr. Henry Hutchins, a skilled mechanic of Gravesend, and counsel said that the tragedy of the case was that Mr. Hutchins, who had parted with £525 for shares, got nothing, and now found himself destitute and having to live on the "dole." He had even to pay the interest on a mortgage on his house which he had raised at the defendant's suggestion to invest in shares. The defendant admitted eight other transactions, besides those mentioned, including the obtaining by false pretences of £2,072 from a Mr. Butterworth of Manchester, £200 from a Mr. Hewitt, to whom he had given a worthless cheque in respect of the sale of a motor lorry, £33 from a Kentish farmer who also had a worthless cheque, £11 from a farmer's wife which he had received for an investment, and £150 which he had received as a premium for the lease of a house. In that case the tenant, after paying the money, was compelled to vacate the premises as the defendant had no lease to dispose of. The defendant repaid the tenant £59 out of the £150 received.

Det.-Sergt. Bennett was called and said that the defendant was educated at Lincoln Grammar School and later became a pupil in the Lincoln Corporation Electricity Works. In 1905 he was assistant engineer to the King's Lynn Corporation, and in 1906 he was the assistant installation inspector to the Manchester City Corporation. From 1915 to 1919 he was employed as works engineer to Messrs. Vickers, of Dartford, and was afterwards in business on his own account, and when arrested he had obtained an appointment as installation superintendent to the York City Corporation at a salary of £275 per annum. The defendant was adjudicated a bankrupt in December of 1920, his liabilities being £7,640 and there were no assets.

The defendant, addressing his Lordship, said that he had never survived his bankruptcy. He admitted that when he was made a bankrupt he did not put the whole question clearly before the Official Receiver and he assumed certain further liabilities. He added that he got involved in all sorts

of ways and his wife either lost or paid out £1,304, six months after his bankruptcy. Since his bankruptcy he did not know how he stood as regarded his liabilities. In conclusion he said that he had been hounded from pillar to post since his bankruptcy. "I have never known what it is to have a moment's rest from crushing liabilities and that is why I have pleaded guilty. I have had enough to last a man a lifetime and now I am determined to get to an end of it," he said.

The JUDGE said it was a painful thing to have to sentence a man of the defendant's ability and upbringing. He had had a good education and a fine grounding in his profession as an electrical engineer and he had attained considerable efficiency in Manchester, Kings Lynn and other places, and there was nothing to show that the defendant was crooked in any kind of way until about the time of his bankruptcy. He found himself in difficulty and had admitted that he did not make a full disclosure to the Official Receiver and he had endeavoured in spite of his bankruptcy to carry on at least one of his undertakings. The Judge went on to say that the defendant got into deeper water and then took to a system of fraud. The defendant had tried to do something in the nature of the things he had suggested to those unfortunate people. It was not a case of merely trying to get their money for a fraudulent purpose although he had behaved fraudulently. The defendant had a good opening in business as Oxley & Co., with a head office in Queen Victoria Street, and a branch office in Tunbridge Wells, and during that time he had defrauded various people of large sums of money and had also obtained goods. Taking into account the time the defendant had been in custody the Judge sentenced the accused to eleven months' imprisonment in the second division.

Malcolm v. Marconi's Wireless Telegraph Co., Ltd.

IN the King's Bench Division, on March 26th, Mr. Justice ACTON delivered his considered judgment deciding in favour of the defendants in this action (see our last issue, p. 518).

His LORDSHIP said that he thought there was a liability by the Marconi Company to pay 5 per cent. commission on all orders obtained from the Chinese Government through the plaintiff's agency, such commission to be payable when the money was received from the Chinese Government. He thought that the defendant company was right in saying that the 5 per cent. commission was limited to the orders obtained as distinguished from loans made by the company to the Chinese Government for the purpose of facilitating that business. Mr. Godfrey Isaacs's letter of July 19th, 1915, must be read as merely assenting to such a proposal. The question then was under the first contract was commission payable on the full £300,000 or upon £220,000 which the company had actually received, the other £80,000 having been rebated to the Government? Defendants had paid the plaintiff £11,000 as commission on the £220,000, but he asked for £4,000 more. His Lordship came to the conclusion that plaintiff could only recover on the £220,000, and that sum he had received. With regard to a claim for commission on £66,000 under contract number two, it was not disputed that plaintiff should have his commission when the company was paid by the Chinese Government. With regard to the third contract, the plaintiff had suffered no damage, and had no claim, so that, in the results, the defendants succeeded in the action with costs, contingent on the payment to the plaintiff of commission on the £66,000 when the money was received from the Chinese Government.

H.M. Inspector of Factories v. Lithgow, Ltd.

AT Greenock recently the Inspector of Factories brought a charge against Lithgow, Ltd., Port Glasgow, to the effect that on December 22nd last it neglected to observe certain provisions in the regulations with regard to the use of electrical energy at Garvel dockyard, when a man was killed. An agent for respondents on March 28th raised the point that the foreman electrician should be included in the charge. The Sheriff decided that the agent, in agreement with the Inspector of Factories, should lay a complaint against the foreman. His Lordship adjourned the case for trial until April 7th.

An Electrical Contractor and Connection to Mains.

IN the Shoreditch County Court, on March 27th, before Judge Cluer, John Frederick Wilson, an electrical contractor, sued Rose Forbes, Bethnal Green, to recover £11 said to be due to plaintiff for an electrical installation at defendant's shop. In evidence plaintiff said that the defendant refused to pay the account until the installation was connected up to the Borough Council's mains. For the defence it was stated that defendant's premises were so far from the mains that it would cost £100 to connect up. The Borough Council had promised to give a supply if six more applications were received. The names of six other persons were sent in by the plaintiff. It was a term of the contract that arrangements should be made for connection to the main supply.

Judge Cluer was of the opinion that plaintiff should be made to wait until the supply was given, as he must have known the circumstances. He would therefore be non-suited.

Tramway Stoppage Caused by a Motorist.

AT Bradford City Police Court, last week, when Ernest Holmes, Bradford, was fined for being drunk while in charge of a motor-car and for dangerous driving, it was stated that after 11 o'clock at night on March 10th his car struck a lamp-post, travelled along the pavement and ran into an electrical section box, causing the dislocation of the tramway service on the long route between Bradford and Bailiff Bridge.

The Rating of Electric Signs.

AT Glasgow Burgh Valuation Court on March 27th, the Assessor stated that he had received a letter from the agents of Messrs. Treron & Co., Ltd., stating that they were extremely dissatisfied with the decision of the Court that the electric signs bearing their name were rateable (*vide* ELEC. REV., March 28th, p. 519), and they were considering appealing against the decision. Accordingly steps were being taken to get other interested parties to join in the matter. The letter suggested further that in the meantime the Court should, without prejudice to either side, agree to a nominal assessment of £5 for the current year. The Assessor said that he had no objection to the entry of £5 in view of the fact that the whole question would be raised later. Continuing, he stated that he had a case where an owner in the city was asking £1,300 per year for a sign not so large as that of Messrs. Treron's. That was why he agreed to the assessment of £5. When the present case came up again the valuation might be greater than £37 10s., his original proposed valuation.

Attorney-General v. Ealing Corporation.

Mr. Justice Romer, in the Chancery Division on March 24th, directed that the action by the Attorney-General against the Ealing Corporation should be in the list for hearing on April 3rd.

His Lordship was informed that it was looked upon as a test case under recent electricity legislation.

The matter has previously been mentioned in our pages (see issue of November 30th, 1923, p. 838).

British Thomson-Houston Litigation.

Mr. Justice Tomlin, in the Chancery Division on March 26th, granted the British Thomson-Houston Co., Ltd., an injunction restraining the Star Lamp Co., of Manchester, from infringing the applicant's patents for tungsten filament lamps. It was stated that the defendants sold lamps which infringed these patents, and the defendants, who were represented by Mr. Max Hacker, said they did so in ignorance of the fact. His Lordship also granted an inquiry as to damages and an order for the delivery up of any infringing articles, and costs.

Interesting points as to the liability of directors, as distinguished from their companies, for patent infringement, were raised in an action, before Mr. Justice Tomlin in the Chancery Division on March 27th, by the British Thomson-Houston Co., Ltd., against Sterling Accessories, Ltd., Bangor House, Shoe Lane, E.C., for an injunction, restraining infringement of one of the plaintiffs' incandescent electric lamp patents.

SIR ARTHUR COLEFAX, K.C., for the plaintiffs, said that the action was against the company and its two directors. There was no denial of the validity of the patent, but the defendants' solicitor had written that the directors would defend the action.

Sir ARTHUR said that the defendant company was registered on December 31st, 1921, with a nominal capital of £1,000 in shares of the nominal value of £1 each. The two individual defendants were the sole directors and shareholders and the only shares issued were two of £1 each. If that was so it was as clear a case as one could possibly imagine of a company being the cloak for the business of two individuals. An injunction therefore against the company would not, he submitted, be a sufficient protection for the plaintiffs.

MR. COURTNEY TERRELL (for the defence) said he was instructed that all the company's shares had been issued—500 each to the two directors. But he accepted all the facts, and submitted that there was no case against the defendant directors.

His LORDSHIP: You admit the sale of the articles and that they infringed the plaintiffs' patent?

MR. TERRELL answered in the affirmative. He went on to say that this particular question of liability had not been argued in these patent cases before, and he cited two judgments in other branches of the law which he submitted proved his contention that the defendant directors were not liable. The fact that they held all the shares in the company was immaterial, and he asked that the action against them should be dismissed with costs.

His LORDSHIP said that he would hear the next case before he gave his decision.

This action was brought by the plaintiffs against Crowther and Osborn, Ltd., of Blackfriars Street, Manchester, and its individual directors.

SIR ARTHUR COLEFAX was again for the plaintiffs, and Mr. MORITZ, who represented the defendant company, said he was

not in a position to resist judgment. Mr. W. A. Greene, K.C., appeared for Messrs. A. W. Porritt and W. F. Crowther (two of the directors), and the third, Mr. H. J. Osborn, appeared in person.

His Lordship was informed that the title and validity of the patent was not disputed.

Sir Arthur Colefax said the defence of Messrs. Porritt and Crowther was that they were not actively engaged in the conduct of the company's affairs, were not cognisant of any infringement, and never authorised or took part in any infringement. The company was formed in September, 1913, with a capital of £25,000, all of which, with the exception of a few pounds, was held by the three directors. A £20,000 debenture had been issued to Mr. Porritt, which was now held by a bank, and a receiver and manager of the company had been appointed.

His case, said counsel, was based upon an agreement between the defendant company (and signed by the three individual defendants) and the Electrical Contractors' Association of Scotland, under which the company agreed to indemnify the Association against the results of any action for infringement brought against their members who sold lamps manufactured by the defendant company. He submitted that this agreement showed that the directors knew of the possibility of infringement, and knew also of what there was to do under the agreement.

Mr. Greene argued that no such inference could be drawn from the agreement, and the indemnity clause was the ordinary precaution which any business man would insist on.

Mr. Osborn said he associated himself with the defences put forward by the other defendants.

His Lordship said he would consider his judgment in both cases against the directors, but against the company he would grant the relief asked for.

In the Chancery Division on March 31st, Mr. Justice Astbury granted an injunction applied for by the British Thomson-Houston Co., Ltd., against D. Rose & Co., restraining the latter from infringing applicants' 1909 patent, with an inquiry as to damages, an order for delivery up of infringing lamps, and costs.

The case of the British Thomson-Houston Co., Ltd., *v.* Metallite Co., was mentioned to Mr. Justice Romer in the Chancery Division on March 24th by Mr. Trevor Watson, who said that the parties had come to terms. The defendants, he said, were willing to consent to judgment in the action, which involved an injunction, and an inquiry as to damages on a patent which had been upheld.

His Lordship asked on what terms the Court of Appeal had directed a certain case to stand over.

Mr. Watson said that that was a case in which the defendants were using for lamps wire purchased from the British Insulated & Helsby Cables, Ltd., who were the defendants before Mr. Justice Russell. It was part of the judgment in that action that the injunction against the defendants should be stayed pending appeal and the Court of Appeal said, in effect, that it would be getting rid of that stay if the plaintiffs sued the customers of the Helsby Co., and they ordered the action to stand over until 14 days after the judgment of the Court of Appeal. It was said that there might be other actions on a similar footing, even though the wire might not have been bought from the same company.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

The hearing of the appeal of the defendants in this action against the decision of Mr. Justice Russell was commenced on Monday last before a Court consisting of the Master of the Rolls and Lords Justices Atkin and Sargant. The action in the Chancery Division was fully reported in our pages.

Sir Duncan Kerly, K.C., in opening appellants' case, said that the matter which the Court would have to consider had been dealt with not only by Mr. Justice Russell, but also in an action in the Scottish Courts, which had been tried in the Scotch Court of Appeal. There were about 60 actions by the respondents pending in the Courts of first instance, the defendants in which were being sued on the respondents' 1909 patent.

After reviewing the history of the incandescent lamp, leading up to the production of the stable tungsten filament, Counsel contended that while the respondents' 1906 patent disclosed an effective process of drawing tungsten wire, there was no subject matter in the 1909 patent, which at the most was a mere discovery of a consequence of working to produce the result which was indicated; it was a necessary consequence. He claimed that the 1909 specification was open to objection in that it was only an application of a known process.

The case is proceeding.

Compensation for Irish Electric Light Co.

At Tralee Sessions last week, before County Court Judge Cusack, the Listowel Electric Light Co. was awarded £14 compensation for damage to the company's electric lighting works at Listowel.

Published Specifications.

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

4,079. "Motor head lights." W. Cook. November 11th, 1922. (211,796.)

24,275. "Electron discharge apparatus and circuit arrangements employing same." British Thomson-Houston Co., Ltd. September 8th, 1921. (185,732.)

26,506. "Electrically-driven valve-grinding machines." Campbell & Isherwood, Ltd., and G. H. Rae. October 2nd, 1922. (212,279.)

30,145. "Electric switches." P. H. Waller. November 3rd, 1922. (212,281.)

30,339. "Stereoscopic X-ray apparatus." L. R. McDonald. November 7th, 1922. (212,285.)

30,425. "Illuminated advertising decorative or other signs or displays." R. H. Parkinson. July 13th, 1923. (212,286.)

33,361. "Cathode ray oscillographs." F. R. F. Ramsay. December 6th, 1922. (212,305.)

33,425. "Electron discharge devices." Western Electric Co., Ltd. July 29th, 1922. (201,514.)

33,477. "Electrical ignition or sparking systems." L. Renault. September 22nd, 1922. (204,262.)

34,674. "Suspension of trucks and motors of tramway, railway, and other vehicles." E. Williams. December 20th, 1922. (212,338.)

34,755. "Welding of rails and other articles." J. Wattmann and Electro-Thermit Ges. December 20th, 1922. (Patent of addition not granted.) (212,339.)

35,035. "Electric switches." H. Trencham and British Thomson-Houston Co., Ltd. December 23rd, 1922. (Cognate application 2,057/23.) (212,342.)

1923.

766. "Vacuum tubes of the 'audion' type." F. Peri. November 7th, 1922. (Addition to 205,511.) (206,805.)

2,244. "Suspension or supporting devices for electric lamps and the like." G. H. Tonks. January 25th, 1923. (212,367.)

3,100. "Telephone earpieces." H. G. Wright. February 2nd, 1923. (212,373.)

4,020. "Method of attachment to mouthpiece of telephone transmitter." H. E. Simpson. February 10th, 1923. (212,376.)

4,066. "Wall plugs for electrical services." E. S. Wilding and "M. K." Electric, Ltd. February 12th, 1923. (212,377.)

4,345. "Receiving apparatus for wireless telegraphy and telephony applicable to wave-meters." C. Seymour and J. Erskine-Murray. February 14th, 1923. (212,381.)

4,430. "Electric switches." R. A. Macaulay. February 15th, 1923. (212,382.)

5,002. "Switchgear and switchboard to interpose into any direct electric current light or power circuit, electric accumulators to be charged." W. Price and M. Price. February 20th, 1923. (212,391.)

6,620. "Long-distance telephony." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 7th, 1922. (194,706.)

6,883. "Tube-feeding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). March 9th, 1923. (212,412.)

6,992. "Crystal detectors." Sterling Telephone and Electric Co., Ltd., and T. D. Ward-Miller. March 10th, 1923. (212,415.)

7,052. "Telephone or headphone terminal board." J. Joanes. March 12th, 1923. (212,416.)

7,504. "Generation of electric current." L'Air Liquide Soc. Anon. Pour L'Etude et L'Exploitation des Procédés G. Claude. May 8th, 1922. (197,363.)

7,525. "Arrangements of electric converting apparatus." English Electric Co., Ltd., J. C. Wilson, and H. Barnes. March 15th, 1923. (Cognate application 10,579/23.) (212,421.)

10,236. "High-frequency method for the preparation of colloidal solutions." S. H. Long. April 16th, 1923. (Cognate application 13,510/23.) (212,442.)

10,896. "Electrical installations, comprising condensers." D. A. Soulier. May 17th, 1922. (197,824.)

11,252. "Electric heating plates." A. Nielsen. April 25th, 1923. (212,449.)

12,174. "Quick-make and quick-break electric switch." B. N. D'Arcy. May 7th, 1923. (212,450.)

12,356. "Telephonic transmitters and receivers." Ges. für Drahtlose Telegraphie. August 30th, 1922. (203,293.)

13,922. "Grinding apparatus." Western Electric Co., Ltd. August 31st, 1922. (203,296.)

14,177. "Wireless receiving apparatus." F. Pascall. May 29th, 1923. (212,463.)

19,118. "Centrifugal regulators suitable for electric motors." J. Bethenod. July 25th, 1922. (201,560.)

22,551. "Electron discharge devices." Western Electric Co., Ltd. September 22nd, 1922. (204,317.)

24,738. "Control of electric motors." Metropolitan-Vickers Electrical Co., Ltd. October 4th, 1922. (205,094.)

29,537. "Acoustic signalling apparatus." Soc. Anon. Pour L'Equipment Electrique des Vehicules. January 5th, 1923. (209,395.)

31,117. "Variable resistances." Soc. Belge Radio-Electrique, Soc. Anon. December 18th, 1922. (208,535.)

A Petrol-Electric Publicity Vehicle.—The Canadian Pacific Railway Co. has recently despatched on a journey through the United Kingdom a special petrol-electric exhibition vehicle with the object of bringing the resources and opportunities of Canada and the transport facilities offered by the C.P.R. before the notice of the people of this country. The chassis is of the Tilling-Stevens standard 2-ton type, on which is mounted a special body van, the sides of which are hinged so that they can be folded back to display examples of Canadian produce, &c. A portable kinematograph displaying apparatus forms part of the equipment, while provision has been made for the electric lighting of the displays when exhibited at night.

Electric Cooking in Melbourne.—An extended use of electric stoves for household cooking in Australia is foreseen by the Canadian Trade Commissioner in Melbourne as a result of demonstrations which have been organised by the City Electric Supply Department. Hitherto electric cooking has been retarded by the lack of experience of such appliances by those to whom they should appeal. Some large hotels and cafés are already using electricity at reduced charges for cooking purposes.